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INTRODUCTION

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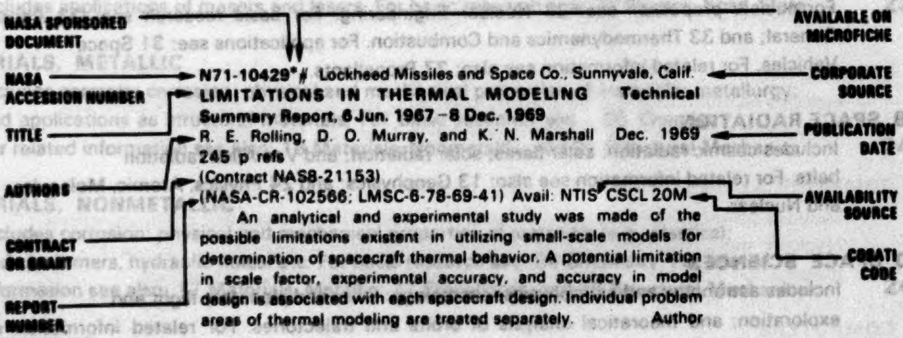

N71-10429*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
LIMITATIONS IN THERMAL MODELING Technical Summary Report, 6 Jun. 1967 – 8 Dec. 1969
R. E. Rolling, D. O. Murray, and K. N. Marshall Dec. 1969
245 p refs
(Contract NAS8-21153)
(NASA-CR-102566; LMSC-6-78-69-41) Avail: NTIS CSCL 20M

An analytical and experimental study was made of the possible limitations existent in utilizing small-scale models for determination of spacecraft thermal behavior. A potential limitation in scale factor, experimental accuracy, and accuracy in model design is associated with each spacecraft design. Individual problem areas of thermal modeling are treated separately. Author

VOLUME 9 NUMBER 2 / JANUARY 23, 1971

Scientific and Technical Aerospace Reports

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01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N71-11001# Weapons Research Establishment, Salisbury (Australia).

THE USE OF RATE GYROSCOPES IN THE FREE FLIGHT MEASUREMENT OF AERODYNAMIC LATERAL FORCE AND MOMENT COEFFICIENTS

N. E. Gilbert Mar. 1970 43 p refs

(HSA-TN-164) Avail: NTIS

Suitable flight data regions are selected for the free flight measurement of aerodynamic force and moment coefficients on two bombs, each with four fins. The bombs carried an incidence meter, three rate gyroscopes, and four linear accelerometers. The flight data are fitted to a mathematical model of the force and moment system. Pitch and yaw rates and pitch and yaw accelerations derived using rate gyroscope measurements are compared with those derived using other sources and the agreement was found to be very good. Static coefficients are found to be equally well obtained using any of the various combinations of rate gyroscope and linear accelerometer measurements. Results are given at a Mach number of 0.6, and very good agreement is obtained between free flight and wind tunnel measurements of the static forces and moments. Author

N71-11002# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.

CIRCULATION CONTROL BY SLOT SUCTION ON A CIRCULAR CYLINDER: PRELIMINARY MEASURED FORCE DATA

R. A. Tyler and R. G. Williamson Feb. 1970 49 p refs

(LR-530) Avail: NTIS

Suction coefficients from zero to unity were applied to a single-slotted commercial steel circular cylinder at low free-stream Mach numbers. Balance measured force data for a full range of slot position in the upper surface are presented and discussed. The results indicate slot position and suction coefficient to be powerful means of controlling cylinder lift. Measurements at zero slot flow demonstrated that the presence of the sharp-edged slot ($s/d = 0.05$) could give rise to sizeable crosswind forces that reversed direction as cylinder Reynolds number was changed through the critical value. Author

N71-11003# National Aeronautical Establishment, Ottawa (Ontario). Unsteady Aerodynamics Section.

DYNAMIC VISCOUS PRESSURE INTERACTION IN HYPERSONIC FLOW

Kazimierz J. Orlik-Rueckemann Jul. 1970 86 p refs

(LR-535; NRC-11598) Avail: NTIS

A method is presented for the determination of boundary layer effect on the unsteady pressure distributions on an oscillating body in continuum hypersonic flow. The method is based on the concept of dynamic viscous pressure interaction, which takes into account the relative motion between the body surface and the boundary-layer displacement surface. The method can be applied to arbitrary bodies and flow conditions, provided the relevant inviscid unsteady pressure distributions and the dependence of the boundary-layer displacement on the steady flow variables are known. In its present version, the method is limited to low-frequency and small-amplitude oscillations. Calculated examples of oscillatory pressure distributions, phase angles, and stability derivatives are given for a few typical flow conditions over slender wedges and slender right circular cones performing oscillation-in-pitch about zero mean incidence and completely submerged in the weak interaction region of a laminar boundary layer. Author

N71-11004*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

JET-WAKE EFFECT OF A HIGH-BYPASS ENGINE ON WING-NACELLE INTERFERENCE DRAG OF A SUBSONIC TRANSPORT AIRPLANE

James C. Patterson, Jr. and Stuart G. Flechner Washington Nov. 1970 47 p refs

(NASA-TN-D-6067; L-7310) Avail: NTIS CSCL 01A

An experimental wind-tunnel investigation has been conducted recently to determine the aerodynamic interference associated with the wing, pylon, and high-bypass fan-jet engines installed on a typical highwing logistics transport airplane configuration and the interference due to the jet wake produced by powered model fan-jet engines. These tests were conducted over a Mach number range from 0.700 to 0.825 at angles of attack from 0 deg to 4 deg. Author

N71-11005# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.

AN EXPERIMENTAL STUDY ON THE UNSTEADY BEHAVIOR OF A SHORT BUBBLE ON AN AIRFOIL DURING DYNAMIC STALL WITH SPECIAL REFERENCE TO THE MECHANISM OF THE STALL OVERSHOOT EFFECT

Koji Isogai Jun. 1970 27 p refs

(Contract DA-31-124-ARO(D)-247)

(AD-711540; ASRL-TR-130-2; AROD-4846-12) Avail: NTIS CSCL 1/3

Unsteady behavior of the reattachment point of a short bubble on a two-dimensional wing of NACA 0012 airfoil section during rapid change of angle of attack was studied by the use of miniature pressure transducers installed in the model for the purpose of detecting the sudden pressure rise at the reattachment point. Tests were made for the range of non-dimensional pitch rate from 0 to 0.25 and Reynolds number from 64,000 to 125,000. The results obtained suggest that the delay of the initiation of the leading edge vortex shedding is, at most, the same order of magnitude as the delay of the movement of the reattachment point. Author (TAB)

N71-11006# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.

A TWO-DIMENSIONAL REPRESENTATION OF THE CROSSWIND FOR THE JET INTERFERENCE PROBLEM

Mary Anne Wright (Ph.D. Thesis) May 1970 156 p refs
Sponsored in part by NSF
(Contract DAHC04-68-C-0004; Proj. Themis)
(AD-711578; GIT-AER-70-4; AROD-T-2-16) Avail: NTIS CSCL 20/4

The problem of a jet exhausting normally from an infinite flat plate into a crosswind is studied analytically, primarily in terms of the resulting interference pressures on the plate. Three jet exit shapes are considered: a circle; an ellipse with the major axis aligned with the crosswind (streamwise exit); and an ellipse with the major axis perpendicular to the crosswind (blunt exit). It is shown that a two-dimensional steady potential flow model for the crosswind in planes parallel to the plate may be used, provided the jet-to-crosswind speed ratio is sufficiently large and the wake region is excluded. A blockage-sink model is developed wherein the blockage elements represent blockage due to the jet plume and due to the presence of the wake and a single sink represents entrainment. The model parameters are presented as functions of speed ratio and jet exit thickness ratio. The blockage and entrainment parameters are varied over a range of values to determine the effects of each on the interference pressure, and it is found that the entrainment factor is quite significant. The streamwise and circular jet exits are more useful for lifting-jet applications than the blunt exit because of their favorable coupling of the blockage and entrainment effects and their relatively small wake production. Author (TAB)

N71-11007# ARA, Inc., West Covina, Calif.

INVESTIGATION OF THE EFFECT OF LEADING EDGE ON THE AERODYNAMIC CHARACTERISTICS OF A 70 DEG SWEPT DELTA WING Final Scientific Report, Nov. 1969 - Jul. 1970

Bernard Mazelsky and Richard B. Lohman Jul. 1970 36 p refs
(Contract F44620-68-C-0027)
(AD-712087; ARA-110; AFOSR-70-1989TR) Avail: NTIS CSCL 1/3

Measurements were taken to determine the effects of varying the gap width of two parallel leading edge slots on the aerodynamic characteristics of a 70 deg swept delta wing. The two major changes over previous model tests were the use of flush slots and study under turbulent boundary layer conditions. The slots were aligned parallel to the leading edges to simulate leading-edge flaps. The report analyzes preliminary computer data and develops a comparative thesis of three delta wing tests. Author (TAB)

N71-11008# Aerospace Research Labs., Wright-Patterson AFB, Ohio.

EFFECT OF UNSYMMETRICAL NOSE-BLUNTNESS ON THE STABILITY DERIVATIVES OF A 10 DEG CONE AT MACH 14 Final Report

Otto Walchner, Frank M. Sawyer, and Kevin E. Yelmgren Jul. 1970 27 p refs
(AD-711921; ARL-70-0119) Avail: NTIS CSCL 20/4

In the analysis of the free flight motion of bodies of revolution, the tricyclic theory assumes that a small configurational asymmetry does not violate the rotational symmetry of the stability derivatives in pitch and yaw but does produce a non-zero trim angle. Tests at Mach 14 show that a small unsymmetric nose bluntness destroys the rotational symmetry of the stability derivatives of a slender cone at hypersonic Mach numbers and therefore severely violates the assumptions of the tricyclic theory. Restoring and damping derivatives in pitch and yaw are reported for a 10 deg cone with symmetric and unsymmetrically blunted noses. The effect of non-equal stability derivatives on the motion are shown for a simplified case. Author (TAB)

N71-11009# National Aerospace Lab., Tokyo (Japan).

DYNAMIC STABILITY TEST IN A TRANSONIC WIND TUNNEL WITH A ROTARY SYSTEM

Yasujiro Kobashi, Nagamasa Kono, Takenori Nishi, and Masafumi Miyazawa May 1970 15 p refs In JAPANESE; ENGLISH summary
(NAL-TR-196) Avail: NTIS

A method is explored for extracting various kinds of aerodynamics derivatives from forces measured in a wind tunnel by rotating a model through a bent rotary sting and a straight rotary sting with attack angles. The experiments are conducted with several models, and the dynamic damping and stiffness derivatives of each longitudinal and lateral direction are obtained. The results of the experiments revealed that this technique is very suitable for dynamic tests in a wind tunnel because of small inertia effect, simple model drive and easy measurement of steady dynamic derivatives which are important at steady turning flight. The measured derivatives are not obtained from pure modes of movement such as pitching or plunging, therefore it is necessary to check whether the assumption of linearity is satisfied. Comparison between the present results and those obtained from the conventional methods showed fairly good agreement. The number of measurements is limited at present, but the obtained values agreed well with theoretical predictions. Author

N71-11010*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

COLD-AIR INVESTIGATION OF A TURBINE WITH TRANSPIRATION-COOLED STATOR BLADES. 2: STAGE PERFORMANCE WITH DISCRETE HOLE STATOR BLADES

Edward M. Szanca, Harold J. Schum, and Frank P. Behning Washington Nov. 1970 25 p refs
(NASA-TM-X-2123; E-5812) Avail: NTIS CSCL 01A

Turbine performance characteristics were obtained for a single-stage axial-flow turbine equipped with stator blades employing transpiration coolant ejection through discrete holes. The turbine was tested over a range of speed and pressure ratio, and with a coolant fraction of 0.03. Additional tests were made at the design speed in which the coolant flow was varied from zero to 0.07 of the primary flow. The results were compared to similar results obtained with a turbine using stator trailing-edge coolant ejection. A base turbine with no cooling provision was used as a standard for comparisons. Author

N71-11011# Naval Postgraduate School, Monterey, Calif.

THE UNSTEADY NORMAL FORCE ON AN AIRFOIL IN OSCILLATING FLOW

Maurice R. Banning (M.S. Thesis) Dec. 1969 174 p refs
(AD-711830) Avail: NTIS CSCL 20/4

The effects of oscillating flow on the pressure force normal to the chord of a symmetrical airfoil were investigated experimentally employing a remote pressure transducer to measure the instantaneous pressure distribution. An open circuit wind tunnel having a set of rotating shutter blades located down stream of the test section was used to produce the oscillating flow. Electrical signals analogous to the free stream velocity and surface pressure were recorded simultaneously on separate tracks of a magnetic tape. The recorded data were converted to digital representation, and numerical techniques utilized to evaluate the spectral composition of the measured pressure distribution, from which the normal force was calculated. It was found that the magnitude of the total normal force at high angles of attack is significantly greater in oscillating flow than in steady flow and is frequency dependent; while at low angles of attack no significant differences were observed. Moreover it was found that higher order harmonics of the fundamental free-stream frequency constitute a significant fraction of the normal force, and these fractions are also frequency dependent. The observed results are not adequately predicted by quasi-steady aerodynamic analysis. Author (TAB)

N71-11012# Oxford Univ. (England). Dept. of Engineering Science.

[AN EXPERIMENTAL INVESTIGATION OF THE LAMINAR

NEAR WAKE BEHIND A CIRCULAR CYLINDER IN A MACH 6, RAREFIED AIR STREAM]
G. P. D. Rajasooria and C. L. Brundin Jun. 1970 103 p refs
(Rept-1108/70) Avail: NTIS

A method is presented whereby the hot wire end loss correction can be directly and accurately determined. The more important resultsare as follows: The surface pressure measurements indicate that the magnitude of the pressure recovery at the base region of the cylinder decreases with decreasing Reynolds numbers. Owing to the relatively small amount of pressure recovery at the base region, there are no separation shocks emanating from the body. The wake shock is a broad, weak recompression area, the strength of which decays rapidly in the downstream axial direction. An expansion region, similar to that found behind slender bodies, is present in the region between the base of the cylinder and the rear stagnation point. Furthermore, an entropy wake is found to exist. This entropy wake is caused by the curved bow shock producing large lateral entropy gradients. Author (ESRO)

N71-11013# National Physical Lab., Teddington (England). Aerodynamics Div.
THE THEORETICAL TREATMENT OF SLOWLY OSCILLATING PART-SPAN CONTROL SURFACES IN SUBSONIC FLOW
H. C. Garner and Doris E. Lehrian Oct. 1969 130 p refs
(NPL-AERO-1303; ARC-31490) Copyright. Avail: NTIS

To first order in frequency, subsonic lifting-surface theory is applied to arbitrary configurations of a thin wing and a trailing-edge control. The discontinuities in flow direction at the hinge line and part-span boundaries are surmounted by independent consideration of smooth equivalent slopes in the chordwise and spanwise directions; the combined equivalent incidences depend on the aerodynamic quantities to be evaluated. The method yields satisfactory values for lift, pitching, and rolling moments, hinge moment and the associated spanwise distributions, but does not determine the complete load distribution due to an oscillating control. Illustrative examples cover four planforms, namely, rectangular and cropped delta wings for which there are experimental data on hinge moment, an untapered swept wing that has been studied by electrical analogue, and a tapered swept wing to be the subject of future experiment. The solutions for each planform are tabulated and plotted as functions of control chord, control span or Mach number and are examined from the standpoint of numerical convergence with respect to the number of chordwise collocation points. Consideration is given to the transformed aerodynamic problem on the reversed wing by application of the reverse-flow theorem, and these alternative numerical results strengthen confidence in the present method and give some indication of the likely accuracy. The optimum central rounding of swept edges is discussed together with many other refinements of numerical technique. It is concluded that significant wing forces can be calculated to at least two-figure accuracy. Author (ESRO)

N71-11014# National Physical Lab., Teddington (England). Aerodynamics Div.
OBSERVATIONS OF THREE-DIMENSIONAL FLOW PATTERNS OBTAINED DURING STALL DEVELOPMENT ON AEROFOILS, AND ON THE PROBLEM OF MEASURING TWO-DIMENSIONAL CHARACTERISTICS Progress Report
N. Gregory, V. G. Quincey, C. L. O'Reilly, and D. J. Hall Jan. 1970 35 p refs
(NPL-AERO-1309; ARC-31702) Copyright. Avail: NTIS

Surface oil-flow patterns were used at low speeds on both thick and thin airfoils to show the onset of three-dimensionality in either separation or re-attachment when there is an appreciable extent of the separated flow that accompanies the development of the stall. Observations on a thick airfoil in compressible flow showed a similar trend in the re-attachment behind a shock-induced separation. A form of boundary-layer control applied at the corners at the ends of the airfoil was able to prevent separation of the corner flow but not to inhibit the development of three-dimensionality. Author (ESRO)

N71-11015# National Aerospace Lab., Amsterdam (Netherlands).
COMPARISON OF CALCULATED PRESSURE DISTRIBUTIONS ON SOME SWEPT WINGS WITH WARREN 12 PLANFORM AT SUBSONIC SPEEDS
A. F. Jones, (RAE, Farnborough), P. V. Grey-Wilson (RAE, Farnborough), and J. W. Slooff 10 Oct. 1969 36 p refs
Sponsored by Direc. of Materiel Air, RNLAF
(NLR-TN-T-189) Avail: NTIS

Data are presented from calculations for the surface pressure distribution on some particular swept wings with Warren 12 planform. Comparisons are given between results obtained from an RAE computer program and a similar program developed at NLR. It is shown that small differences exist as a consequence of different numerical procedures and slight changes in formulation of the basic method. Additional comparisons with a numerical solution of the exact equation for incompressible potential flow suggest that thickness effects are reasonably well represented for the configurations considered. Author (ESRO)

N71-11016# National Physical Lab., Teddington (England). Aerodynamics Div.
LOW-SPEED AERODYNAMIC CHARACTERISTICS OF NACA 0012 AEROFOIL SECTION, INCLUDING THE EFFECTS OF UPPER-SURFACE ROUGHNESS SIMULATING HOAR FROST
N. Gregory and C. L. O'Reilly Jan. 1970 41 p refs
(NPL-AERO-1308; ARC-31719) Copyright. Avail: NTIS

Results are presented for the aerodynamic characteristics of NACA 0012 airfoil section at Reynolds numbers of 2.88 million and 1.44 million with some indications of scale effect at other Reynolds numbers. The measurement of the maximum lift coefficient at a Reynolds number of 2.88 million was uncertain because a laminar separation bubble disappears intermittently for reasons that are not fully understood and it was found that the flow broke down into a three-dimensional pattern when an appreciable extent of separation was present. Boundary-layer control by suction in the vicinity of the wing/wall junction was shown to improve the two-dimensionality in the early stages of separation, but did not inhibit the appearance of three-dimensional flow at and beyond the stall. Distributed roughness was progressively applied from the trailing edge forwards over the upper surface of the airfoil. Both sparse and dense distributions were used and they were intended to simulate the hoar frost deposit remaining after partial cleaning of the forward part of the airfoil. Subject to the above qualifications the maximum lift coefficient was not greatly reduced until the front edge of the roughness extends forward of 0.1 chord, at which stage the drag increment due to the roughness rapidly became much larger. Author (ESRO)

N71-11017# Von Karman Inst. for Fluid Dynamics, Rhode Saint-Genese (Belgium).
A PARAMETRIC STUDY OF ADIABATIC LAMINAR BOUNDARY LAYER SHOCK WAVE INTERACTIONS BY THE METHOD OF LEES-REEVES-KLINEBERG
M. L. Riethmuller and J. J. Ginoux Jun. 1970 90 p refs
(VKI-TN-60) Avail: NTIS

The problem of the interactions between a shock wave and a laminar boundary layer with emphasis on the adiabatic case is briefly discussed. A computer program is described which has been used for a parametric study, the results of which are presented graphically. Ranges of Mach number from 1.5 to 6.0, and of Reynolds number per meter from 0.8 million to 0.1 x 10 to the 8th power are considered. A study of incipient separation shows good agreement with the theoretical results with the correlation established from experimental data by Needham and Stollery. The listing of the computer program used for this study is also given. Author (ESRO)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N71-11018# National Aviation Facilities Experimental Center, Atlantic City, N.J.
FIRE PROTECTION TESTS IN A SMALL FUSELAGE-MOUNTED TURBOJET ENGINE AND NACELLE INSTALLATION Final Report, 1965–1970
Daniel E. Sommers Nov. 1970 61 p refs
(FAA-NA-70-41; FAA-RD-70-57) Avail: NTIS

Tests under simulated flight conditions were conducted to investigate the potential explosion and fire hazards and detection and fire control methods. Hot surface ignition of flammables did not occur during simulated flight operating conditions until a change to the normal nacelle configuration reduced cooling airflow to the hot section of the engine (Zone 1) below 0.15 pound per second. The installed detection system did not provide for prompt detection of all fires originated in the lower forward portion of the compressor compartment (Zone 2). Both the Zone 2 fire detection and the Zone 1 overheat detection system, were sensitive to fires originating in the inboard portion of Zone 2. The installed extinguishing system provided rapid extinguishment of all Zone 2 fires until extensive accumulative damage from fires destroyed the integrity of the zone. Fireproof protection incorporated in the nacelle was very effective in performing its intended function. Most susceptible to damage by fire was the aluminum portion of the nacelle, especially aluminum receptacles for camlock type fasteners, an aluminum ventilation louver panel in the top aft portion of Zone 2, and aluminum ribs, formers, and baffles inside the nacelle in the path of fire. The fire damage to the engine and accessories was insignificant in regard to engine operation. Author

N71-11019# National Aviation Facilities Experimental Center, Atlantic City, N.J.
INVESTIGATION OF TWO METHODS FOR IMPROVING THE CRASHWORTHINESS OF INTEGRAL FUEL TANKS Final Report, 1967–1970
Robert H. Ahlers Nov. 1970 19 p ref
(FAA-NA-70-46; FAA-RD-70-56) Avail: NTIS

F-86 droppable fuel tanks, fitted with reticulated polyurethane foam and filled to capacity with JP-4 fuel, were drop tested and catapulted to test the effectiveness of the foam in reducing fuel spray and leakage at impact. Also, structurally reinforced DC-7 integral wing tanks were impacted against an upright beam restrained by a steel shear pin to limit the loads. The forward spar caps were strengthened with aluminum alloy doublers and chordwise stiffeners to determine the effect of structural modifications on the crashworthiness of the structure. It was determined that the 10 pores per inch and the 60 pores per inch polyurethane foam have little effect on the attenuation of fuel misting and spilling. The addition of a 0.040 inch thick doubler strip to the upper and lower DC-7 wing skins did not appreciably decrease the vulnerability of the integral tank to leakage, but the front spar rails when reinforced by chordwise structural shapes did increase impact resistance. Author

N71-11020# Federal Aviation Administration, Washington, D.C. Flight Standards Service.
MODERN SURVEILLANCE OF AIRCRAFT INTEGRITY
James E. Dougherty [1969] 32 p refs Presented at the 5th Ann. Aviation Maintenance Symp. Advances in Aviation Maintenance Technol., Oklahoma City, 9–11 Dec. 1969
Avail: Issuing Activity

Terminology such as overhaul at fixed times, progressive maintenance, sampling techniques, on condition, reliability, and condition monitoring is noted. The relationship between industry and government in the formulation, evaluation, and approval of maintenance programs is discussed, as is the need for realistic and scientific appraisal of modern day aircraft maintenance programs. The paper's prime purpose is to help speed up recognition and acceptance of condition monitoring as applied to the forthcoming family of large transport jets, as well as the supersonic transports still in the embryonic stage. Conjecture is devoted to the possibility of condition monitoring serving as the basis for future development of maintenance programs for many of the complex high speed executive jet powered aircraft now in use and now being developed for entry in the general aviation field. Author

N71-11021# Young (Arthur) and Co., Bethesda, Md.
PASSENGER DEMAND AND MODAL SPLIT MODELS: CALIBRATION AND PRELIMINARY ANALYSIS
J. M. McLynn and T. Woronka Dec. 1969 172 p refs
Supported in part by Dept. of Transportation
(Contract NBS CST-468)
(PB-190946; NECTP-230) Avail: NTIS CSCL 13B

The report develops demand and modal split models for passenger transportation in the Northeast Corridor of the United States. These models are to be used for estimating the patronage on intercity transportation systems in the time period up to 20 years in the future. The uniqueness of these models is that they can be used to estimate patronage on many existing and new modes simultaneously and consistently, ensuring the compatibility of the several estimates. Author (USGRDR)

N71-11022# Naval Academy, Annapolis, Md.
FLYAWAY SEAT
Samuel R. Swah 15 May 1970 128 p
(AD-711642; USNA-TSPR-3) Avail: NTIS CSCL 1/3

An investigation was made to test the feasibility of the use of the flexible rotor blades for a new type of ejection system to be used by pilots in military service to maneuver to safety rather than remain on the mercy of the wind in a parachute. Among designs being considered is an ejection system which works on the autogyro principle. Since prior research has already been done on flexible blades, the primary problem was to adapt them to an ejection system. Different blade configurations were tested in order to find one which would be stable through all ranges of RPM, within the structural limits of the blade and which would satisfactorily autorotate. Results indicate that the use of flexible blades on an escape system is feasible and very advantageous due to their light weight and ease of storage within the limited confines of a cockpit. The construction of a model was also undertaken which will be used to test the autorotative qualities of the blades. Author (TAB)

N71-11023# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
OPTIMIZATION TECHNIQUES IN AIRCRAFT CONFIGURATION DESIGN
Brent Silver and Holt Ashley Jun. 1970 59 p refs
(Contract F44620-68-C-0036)
(AD-711410; SUDAAR-406; AFOSR-70-2361TR) Avail: NTIS CSCL 1/3

The application of optimization techniques to aircraft configuration design is discussed. Advantages and disadvantages of automated search methods are compared with those of parametric analysis methods. The formulation of the design problem for direct search methods using a normalization procedure is developed. Various direct methods are briefly described. Operational results using several of these methods are reported for aircraft configuration design problems. Gradient methods are found to give disappointing results when compared with certain non-gradient methods. Reasons are suggested for this behavior. The future promise of man-computer interactive design is briefly described. Author (TAB)

N71-11024# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.

AIRCRAFT ACCIDENT REPORTS: BRIEF FORMAT, US CIVIL AVIATION, ISSUE NO. 4, 1969 ACCIDENTS

Aug. 1970 501 p *Its* File No. 1-0047-0057; 0059;3-2701-2999,3001-3600
(NSTB-BA-70-4) Avail: NTIS

Sixty-four accidents including foreign registered aircraft involved in accidents in the U.S. are presented. The types of aircraft, pilot certificates, accidents, aircraft damage, and human injuries are listed in tabular form. J.A.M.

N71-11025*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

WIND-TUNNEL INVESTIGATION OF VARIOUS SMALL-SCALE ROTOR/WING CONFIGURATIONS FOR VTOL COMPOSITE AIRCRAFT IN THE CRUISE MODE

James P. Shivers Washington Oct. 1970 227 p refs
(NASA-TN-D-5945; L-7133) Avail: NTIS CSCL 01C

A subsonic wind-tunnel investigation of a small-scale rotor/wing VTOL airplane has been conducted in a low-speed tunnel with a 12-foot octagonal test section at the Langley Research Center to determine the aerodynamic characteristics of the model in the cruise mode. Five three-blade and three four-bland rotor/wing planforms were tested on a model with a conventional fuselage and tails. The investigation consisted of tests in the cruise configuration to determine lift, drag, static stability and control characteristics, and the dynamic rolling-stability derivatives. Studies with the rotor/wing fixed at various azimuth angles were made to determine the rolling and pitching moments due to variation of the azimuth angle and the effectiveness of the controls for countering these moments. Author

N71-11026# National Aeronautics and Space Council, Washington, D.C.

THE STATUS OF FEDERAL INVOLVEMENT IN SHORT HAUL AIR TRANSPORTATION

Richard D. FitzSimmons and William E. Thurman [1970] 3 p
Avail: Issuing Activity

Interagency cooperation is discussed that could lead to a short haul air transportation program taking into account the realities of fiscal restraints and the somewhat overlapping agency responsibilities. Some of the aspects of federal involvement are discussed. Some thoughts on the interaction of civilian and military agencies and the private industry and municipalities are described. Finally, the impact of this new involvement of the government is developed in view of the many benefits which should accrue to the nation. Author

N71-11027# Mitre Corp., Baileys Crossroads, Va.

V/STOL MODE DESCRIPTIONS

Donald Goldman and Michael J. Roberts Dec. 1969 68 p refs
(Contract DOT-7-35248)
(PB-190940; MTR-4113; NECTP-220) Avail: NTIS CSCL 01B

The report documents the various vertical takeoff and landing (VTOL) and short takeoff and landing (STOL) modal configurations used in the generation of the 1969 NECTP (Northeast Corridor Transportation Project) record run series. A modal configuration can be described by its network and by the vehicles which traverse that network. The report presents the physical and economic characteristics of the VTOL and STOL vehicles and the terminals and links which comprise their service networks. Author (USGRDR)

N71-11028# Rhode Island Statewide Comprehensive Transportation and Land Use Planning Program, Providence.

STATE AIRPORT SYSTEM INVENTORY: AN INVENTORY OF THE EXISTING AIRPORT SYSTEM IN RHODE ISLAND

Kent L. A. Zimmerman, William M. Davies, and Richard J. Shapiro Oct. 1969 163 p refs Supported by HUD and Dept. of Transportation *Its* Tech. Paper No. 14
(PB-189332) Avail: NTIS CSCL 01E

Contents: Rhode Island aviation history, State operated airports and heliport, Private airports, Military airports and heliports, and Data summary. USGRDR

N71-11029# Mitre Corp., Baileys Crossroads, Va.

AIR MODE SERVICE ANALYSIS IN THE NORTHEAST CORRIDOR

Michael J. Roberts and Donald Goldman Dec. 1969 209 p refs
(Contract DOT-7-35248)
(PB-190935; MTR-4112; NECTP-215) Avail: NTIS CSCL 01B

The innovative air modes analyzed for the NECTP (Northeast Corridor Transportation Project) were vertical takeoff and landing (VTOL) and short takeoff and landing (STOL). The report describes the air mode operator supply models and the procedures which generate the VTOL and STOL modal service characteristics within the NECTP model system. The results of all of the model system runs containing VTOL or STOL are analyzed and presented in summary form. Author (USGRDR)

N71-11030# United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.

EFFECT OF ROOT CUTOUT ON HOVER PERFORMANCE

Final Report, Jun. 1969 – Apr. 1970

Sebastian J. Cassarino Wright-Patterson AFB, Ohio AFFDL Jun. 1970 63 p refs
(Contract F33615-69-C-1176)
(AD-711396; SER-50661; AFFDL-TR-70-70) Avail: NTIS CSCL 1/3

Tests were conducted to determine the effect of blade root cutout on the hovering performance of a helicopter rotor. Rotor thrust and torque characteristics were measured on model rotors with root cutouts of 10, 25, 40, and 50 percent radius. In addition, smoke was ejected from various spanwise locations along the trailing edge of blades with cutouts of 10 and 50 percent. The wake patterns developed below the hovering rotor were photographed and examined for several rotor speed/collective pitch combinations to determine how these parameters affect the wake structure. The test data revealed a loss in hovering efficiency of 5 to 7 percent for the 50 percent cutout rotor at a typical design thrust coefficient. This result is in agreement with previous calculations made using blade element-momentum theory. The loss in hovering efficiency was highly nonlinear with increasing root cutout. This behavior was not predicted by blade element-momentum theory or a prescribed wake hover performance analysis using a standard wake pattern. The flow visualization phase of the investigation showed that the increase in root cutout decreases the radial contraction of the tip vortex. When this result was included in the prescribed wake analysis, the correlation accuracy was improved. Author (TAB)

N71-11031# Air Force Cambridge Research Labs., Bedford, Mass.

POINT AND ROUTE TEMPERATURES FOR SUPERSONIC AIRCRAFT

Irving I. Gringorten and Paul Tattelman 28 Jul. 1970 200 p refs *Its* AFCRL-AFSIG-223
(AD-712017; AFCRL-70-04) Avail: NTIS CSCL 4/2

The atlas of the Northern Hemisphere temperature field at SST altitudes consists of 84 plates showing the isotherms at each of the constant-pressure levels, 100, 50, and 30 mb, standard altitudes of 53,000, 67,500, and 78,500 ft, respectively. For each level and season there are seven maps giving the 2-, 10-, 25-, 50-, 75-, 90-, and 98-percentile temperatures. The charts were prepared from twice-daily grid-point data obtained from charts covering the area from the North Pole to approximately 15 deg N for the period 1959 to 1969. Charts were computer analyzed. Since fuel consumption of supersonic aircraft is quite dependent upon temperature, each of the 84 plates is accompanied by a graph giving the probability that the temperatures on any route plotted on the map will equal or exceed the temperatures shown on the map. While the 84 maps are intended for straightforward informational use in SST flight-planning, there are many noteworthy features that are revealed by the percentile-type presentation. Author (TAB)

N71-11032*# Tracor, Inc., Austin, Tex. Sociometric Research Div.

COMMUNITY REACTION TO AIRPORT NOISE, VOLUME 2 Final Report

4 Sep. 1970 245 p refs
(Contract NASw-1549)
(NASA-CR-111316; T-70-AU-7454-U-Vol-2) Avail: NTIS CSCL 01E

A study of the relationships of large numbers of variables (physical, psychological, and social) with community reaction to the noise of aircraft around international airports in large U.S. cities is described. The seven major airports involved were Logan International-Boston, O'Hare International-Chicago, Dallas International-Dallas, Stapleton International-Denver, Los Angeles International-Los Angeles, Miami International-Miami, and Kennedy International-New York. Author

N71-11033# TRW Systems Group, Washington, D.C.

HSGT SYSTEMS ENGINEERING STUDY, TRACKED AIR CUSHION VEHICLES Final Report, 1967–1969

Dec. 1969 606 p refs
(Contract DOT-C-353-66)
(PB-190939; NECTP-219) Avail: NTIS CSCL 13F

Based on requirements and constraints chosen for an operational system, subsystem alternatives are evaluated and the selected subsystems are synthesized into a TACV system. Cost and performance are estimated over a range of parameters such as design cruise speed (150 to 350mph) and vehicle capacity (50 to 150 passengers per vehicle). The configuration defined consists of trainable, electrically powered TACV's which collect power from trackside power rails mounted on the side of a channel guideway. Propulsion is by linear induction motors with variable frequency speed control. Control of the vehicles, singly or in trains, is automated and centralized. The vehicles are supported on and guided by peripheral jet air cushions with high pressure air provided by electrically driven axial flow compressors. Author (USGRDR)

N71-11034# Committee on Government Operations (U.S. Senate).

TFX CONTRACT INVESTIGATION, SECOND SERIES, PART 2

Washington GPO 1970 220 p refs Hearings before Comm. on Govt. Operations, 91st Congr., 2d Sess., 25–26 Mar., 7, 9, and 14 Apr. 1970
Avail: Permanent Subcomm. on Invest.

Congressional testimony is reported on investigation of the TFX aircraft contract. Testimony is given on the primary mission of the aircraft, the contract schedule, proposed changes in the design, and difficulties encountered during development and testing. R.B.

N71-11035# Institut Franco-Allemand de Recherches, St. Louis (France).

GROUND AND BUILDING WALL REGISTRATIONS OF BOOMS AND NOISES CAUSED BY STARFIGHTERS AND OTHER SOURCES [KNALLE UND GERAUSCHE VON STARFIGHTERN UND ANDEREN QUELLEN, AN BODENPUNKTEN UND HAUSWANDEN REGISTRIERT]

M. Froboese, G. Mathieu, and D. Seydel 27 Jan. 1970 129 p refs In GERMAN; FRENCH summary
Avail: NTIS

The mechanical effects of sonic booms and detonation waves on buildings were studied during overflights of supersonic Starfighters, as well as in connection with explosive detonations of varying force and density, and through shock waves triggered by ordnances of differing calibers. Pressure loads and shock wave pressure-time propagation were measured and registered at several points on the building's wall and in its vicinity in order to determine qualitative and quantitative modifications in supersonic waves during their propagation along the measuring points. Also measured were noise effects of low flying Bell UH-1D and Sikorsky H 34 helicopters and the F 104 on several components of the test building. Transl. by G.G.

N71-11036# Institut Franco-Allemand de Recherches, St. Louis (France).

SONIC BOOM PROPAGATION DURING SUPERSONIC FLIGHT IN UNPERTURBED ATMOSPHERE. PART 1: HORIZONTAL STRAIGHT FLIGHT [PROPAGATION DU BRUIT BALISTIQUE D'UN AVION DANS L'ATMOSPHERE NON PERTURBEE. LERE PARTIE: AVION EN VOL RECTILIGNE HORIZONTAL]

F. Reggiani 25 Feb. 1969 36 p refs In FRENCH; GERMAN summary
(Contract DRME-69/415)
Avail: NTIS

Numerous formulas are presented that are applicable to the analysis of sonic aircraft boom propagation during supersonic flight in an unperturbed atmosphere. Sound wave characteristics are used to form the equations for determining the caustic, its intersecting ground points, as well as expressions for the radii of curvatures at some important points. The two cases considered are: (1) a homogeneous atmosphere; and (2) an atmosphere with constant temperature gradients. Example calculation results for real situations are included; the flight path is always considered rectilinear and horizontal and the atmosphere unperturbed. Transl. by G.G.

N71-11037* National Aeronautics and Space Administration. Langley Research Center, Langley Sation, Va.

HOT AIR BALLOON DECELERATION AND RECOVERY SYSTEM Patent

Stanley H. Scher and James C. Dunavant, inventors (to NASA) Issued 28 Apr. 1970 (Filed 14 Nov. 1968) 5 p Cl. 244-31; Int. Cl. B64b; Int. Cl. B64g Continuation-in-part of US Patent Appl. SN-665682, Filed 31 Aug. 1967
(NASA-Case-XLA-06824-2; US-Patent-3,508,724; US-Patent-Appl-SN-775966) Avail: US Patent Office CSCL 01C

A hot air balloon deceleration and recovery system is described. The balloon is equipped with ram air openings which permit inflation by admitting aerodynamically heated air. The balloon inflates during the descent trajectory and acts as a decelerating device. Materials used in the construction of the balloon and methods of fabrication are discussed. Author

N71-11038* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

CONTROL FOR FLEXIBLE PARAWING Patent

Francis M. Rogallo and William C. Sleeman, Jr., inventors (to NASA) Issued 21 Mar. 1967 (Filed 9 Feb. 1966) 6 p Cl. 244-44 Continuation-in-part of US Patent Appl. SN 338535, Filed 17 Jan. 1964
(NASA-Case-XLA-06958; US-Patent-3,310,261; US-Patent-Appl-SN-551815) Avail: US Patent Office CSCL 01C

A method for controlling a flexible wing is described. Boltropes from the trailing edge of the flexible wing to a control unit in the payload provide the control system. Control is accomplished by shortening or lengthening the boltrope. By changing the wing configuration symmetrically, pitch control is provided, while asymmetrical variation of the wing planform will provide roll control. Response of the vehicle is dependent upon the rate at which the boltrope is shortened and lengthened, this speed being determined by a conventional servo mechanism. P.N.F.

N71-11039* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
GRAVITY STABILIZED FLYING VEHICLE Patent
Harold I. Johnson, inventor (to NASA) Issued 20 Jan. 1970 (Filed 14 Nov. 1968) 6 p Cl. 244-23; Int. Cl. B64c
(NASA-Case-MSC-12111-1; US-Patent-3,490,721; US-Patent-Appl-SN-775877) Avail: US Patent Office CSCL 01C

A hovering-type flying vehicle for manned or unmanned use is described in which the lift vector is normally aligned with the direction of the prevailing gravity vector without the need for ancillary stabilizing systems such as gyroscopes or manned guidance. The vehicle consists of an upper body section for containing the payload, a lower body section for housing the lifting engine and its related components, as essentially frictionless universal-type joint affixing the upper body to the lower body, and a biasing means between the bodies at the joint which is set to retain the centers of gravity of the bodies along a common axis. Illustrations of the vehicle embodying the principle concepts and basic mechanisms in a static stable condition and subsequent to a destabilizing condition are included. J.M.

N71-11040# Royal Aircraft Establishment, Farnborough (England).
SOFT-GROUND ARRESTING OF CIVIL AIRCRAFT: INFLUENCE OF GRAVEL DEPTH AND TYRE INFLATION PRESSURE
E. Bade Jan. 1969 17 p refs
(RAE-TR-69001) Copyright. Avail: NTIS

The arresting trials carried out with a Lightning aircraft to examine the influences of gravel depth and tire inflation pressure on deceleration are described. The mean decelerations achieved at normal main wheel tire pressures of 260 lb/sq in in a 30 inch depth of 3/4 inch - 1/4 inch rough irregular gravel have compared with previous results in depths of 12 inches and 18 inches. They show that mean deceleration can be increased by an increase in gravel depth but not in direct proportion and that the effectiveness of increased depth is greatest at lower aircraft speeds. Mean decelerations achieved at main wheel tire pressures of 190 lb/sq in were lower than those at 260 lb/sq in but the difference was only slight. Compaction of the gravel occurred due to increased depth and to the fact that the gravel had laid undisturbed for a long period. It is recommended that harrowing a gravel arrester to the full depth would be worthwhile about every 6 months. Author

N71-11041* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
VARIABLE SWEEP AIRCRAFT Patent
Edward C. Polhamus and Alexander D. Hammond, inventors (to NASA) Issued 6 Sep. 1966 (Filed 30 Mar. 1965) 7 p Cl. 244-46
(NASA-Case-XLA-03659; US-Patent-3,270,989; US-Patent-Appl-SN-444087) Avail: US Patent Office CSCL 01C

A variable sweep wing employing provisions to compensate for undesirable longitudinal stability problems encountered by variable sweep aircraft is described. A double-pivot segmented variable sweep wing eliminates longitudinal pitch-up without the necessity of a low horizontal tail position and compensates for a portion of the aerodynamic center shift during changes in wing sweep angle. The configuration incorporates an auxiliary movable surface at the junction of the leading edge with the fuselage. Movement of the auxiliary surface during wing sweep operations provides increased longitudinal stability. P.N.F.

N71-11042# Royal Aircraft Establishment, Farnborough (England).
REQUIREMENTS FOR EJECTION SEAT SYSTEMS [ANFORDERUNGEN AN SCHLEUDERSITZSYSTEME]
U. Schmidt Jun. 1970 25 p refs Transl. into ENGLISH from Deutsche Luft- und Raumfahrt. (West Ger.), Mitt 69-11 p 372-393
(RAE-LIB-Trans-1471) Avail: NTIS

The requirements for ejection seat systems are expounded and discussed in terms of some extreme flight conditions, specified by the parameters: airstream velocity, altitude, attitude and rate of descent. The physiological and functional limiting conditions are indicated, and some possible means of extending the performance range of rescue systems are presented. Author

N71-11043* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TRANSLATING HORIZONTAL TAIL Patent
Morris L. Spearman, inventor (to NASA) Issued 3 Feb. 1970 (Filed 5 Mar. 1968) 5 p Cl. 244-43; Int. Cl. B64c
(NASA-Case-XLA-08801-1; US-Patent-3,493,197; US-Patent-Appl-SN-710533) Avail: US Patent Office CSCL 01C

A method for improving aircraft stability through translational motion of the horizontal tail surface is described. The horizontal tail surface is located at the aft of the fuselage during low speed flight and is moved forward toward the fixed wing trailing edge as airspeed increases. Variations in the positions of the tail surfaces provide lift, control, and stability in varying amounts depending on the airspeed of the aircraft. P.N.F.

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N71-11044# Etudes Techniques et Constructions Aerospatiales, Charleroi (Belgium).
DEVELOPMENT OF AN ADVANCED CONTROL CIRCUIT FOR SATELLITE POWER SYSTEMS Progress Report 1969
A. Dumont, J. P. Roffler, N. Limbourg, and A. Poncin Paris ESRO Mar. 1970 49 p refs
(Contract ESTEC-616/68al)
(ESRO-CR-15; PR-1) Avail: NTIS

An improved method for the electronic control of the power sources in a satellite is described. It is shown to have three main advantages: (a) optimum loading of the solar array, (b) load sharing between power regulators to control high power levels and (c) stability of operation. The report introduces the study, discusses the literature and gives the basic options taken. Author (ESRO)

N71-11045# Sandia Corp., Albuquerque, N.Mex. Space Isotope Power Dept.
THE EVAPORATIVE EROSION OF THERMOELECTRIC ELEMENTS IN SOME THERMOELECTRIC GENERATORS
R. D. Kinney Sep. 1970 32 p refs Sponsored by AEC
(SC-RR-70-534) Avail: NTIS

A model is presented and a parametric analysis is made of the evaporative erosion of material from thermoelectric elements during operation of some thermoelectric generators. The relative influence of parameters is noted and limitations of the model are discussed. Author

N71-11046# Royal Aircraft Establishment, Farnborough (England).
ON THE INFRARED RESPONSE OF SILICON SOLAR CELLS AS A FUNCTION OF THICKNESS
R. M. Jenkins Jun. 1969 34 p refs
(RAE-TR-69126) Copyright. Avail: NTIS

The performance of thin solar cells is compared with that of conventional thick cells and the factors affecting the response as a function of thickness are discussed. By using a simple one-dimensional model, equations are derived for the contribution to the response of a solar cell from the base region. The analysis shows that the main factor causing loss of infrared response as the thickness decreases is the loss of generated carriers to the rear ohmic contact. Correlation with experimental results indicates the adequacy of the simple theory. Author

N71-11047# Royal Aircraft Establishment, Farnborough (England).
A STUDY OF AMERICAN RADIATION RESISTANT LITHIUM SOLAR CELLS
R. L. Crabb Mar. 1969 18 p refs
(RAE-TR-69044) Copyright. Avail: NTIS

The performance characteristics of twenty-five American lithium-doped p on n silicon solar cells were evaluated following sequential 1 MeV electron irradiation for fluences up to 10 to the 16th power electrons/sq cm. Although the self-healing performance recovery exhibited by these cells at room temperature following electron irradiation was impressive, their n-type base silicon sustained much greater damage than the p-type base silicon of the n on p, 10 ohm-cm control cells. Thus the end-of-life performance (fluences exceeding 10 to the 15th power electron/sq cm) was, at best, worse than that of conventional n on p, 10 ohm-cm cells. The best irradiation performance of the lithium cells remained unchanged for three thousand hours. Author

N71-11048*# Hughes Aircraft Co., El Segundo, Calif. Space Systems Div.
HIGH VOLTAGE SOLAR ARRAY CONFIGURATION STUDY Final Report
B. G. Herron, D. E. Creed, R. W. Opjorden, and G. T. Todd Jul. 1970 180 p refs
(Contract NAS3-8996)
(NASA-CR-72724) Avail: NTIS CSCL 10B

A detailed conceptual design study of high voltage solar arrays with integral power conditioning, capable of providing high voltage regulated power (15 kW, 1 to 16 kV) to multiple loads was performed. The major areas considered were: (1) solar array power subdivision; (2) regulation; (3) power transfer and reconfiguration; (4) components for mechanization; (5) array performance; and (6) questions related to high voltage design, fabrication, and testing. The general conclusions are that high voltage arrays are feasible and that they can out-perform conventional power conditioning systems operated from low voltage arrays. The results are applicable to most space missions utilizing solar electric power. Author

N71-11049* Radio Corp. of America, Princeton, N.J.
SOLAR CELL INCLUDING SECOND SURFACE MIRRORS Patent
Ralph R. Scott, inventor (to NASA) Issued 6 Oct. 1970 (Filed 30 Jan. 1968) 5 p Cl. 136-89; Int. Cl. H01e Sponsored by NASA
(NASA-Case-NPO-10109; US-Patent-3,532,551;
US-Patent-Appl-SN-701654) Avail: US Patent Office CSCL 10B

A method for modifying an existing solar cell array to reduce the overall temperature of the array without any major redesign of the structure is presented. A cover plate of light transmitting material, with a portion overhanging the edges of the cell, has a reflective coating on the underside. The temperature of the cell is controlled by regulating the overhanging area. F.O.S.

N71-11050* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLAR BATTERY WITH INTERCONNECTING MEANS FOR PLURAL CELLS Patent
Donald W. Ritchie and John V. Goldsmith, inventors (to NASA) Issued 27 May 1969 (Filed 7 Sep. 1966) 5 p Cl. 136-89; Int. Cl. H01l Sponsored by NASA
(NASA-Case-XNP-06506; US-Patent-3,446,676;
US-Patent-Appl-SN-577776) Avail: US Patent Office CSCL 10B

Apparatus is described which mechanically connects a multiplicity of solar cells to a substrate and electrically interconnects them into a series-parallel electrical connection for forming a solar battery. Electrical conductive members include a plurality of tynes which project through the insulative substrate and are mechanically biased against the surface of the solar cells so as to hold them in a side by side juxtaposed relationship on the substrate. The series electrical circuits provide required voltages from the solar battery while the parallel electrical circuits provide required electrical current. D.L.G.

N71-11051* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SEALED BATTERY GAS MANIFOLD CONSTRUCTION Patent
Gayle M. Wylie, inventor (to NASA) Issued 1 Nov. 1966 (Filed 20 Apr. 1964) 3 p Cl. 136-170 Sponsored by NASA
(NASA-Case-XNP-03378; US-Patent-3,282,740;
US-Patent-Appl-SN-360878) Avail: US Patent Office CSCL 10C

A sealed battery which has a gas manifold interconnecting all of the cells is described. The development of an electrolyte path between cells is substantially prevented, and additional gas expansion volume is provided. The stand-pipe extending into each cell insures that each cell will have a certain amount of electrolyte-free space, each stand-pipe having a tapered end near the electrolyte rendering it free of short circuiting even in an inverted position as encountered in missile and spacecraft use. In addition to the above mentioned advantages, the tortuous path gas manifold construction provides a means for gases which might be evolved in a weak cell to travel to a stronger cell and be recombined with the electrodes in the stronger cell. Still another advantage is that the intercell walls can be made thinner and lighter since no differential pressure can develop between cells. The design is particularly applicable to alkaline cells having silver-zinc, silver-cadmium, or nickel-cadmium electrodes. Illustrative drawings are included for several features of the sealed electric storage battery. E.M.C.

N71-11052* Electro-Optical Systems, Inc., Pasadena, Calif.
ELECTROLYTICALLY REGENERATIVE HYDROGEN-OXYGEN FUEL CELL Patent
Bernard M. Wilner, Harvey A. Frank, Eugene Findl, and Martin G. Klein, inventors (to NASA) Issued 21 Apr. 1970 (Filed 17 May 1967) 8 p Cl. 136-86; Int. Cl. H01m Sponsored by NASA
(NASA-Case-XLE-4526; US-Patent-3,507,704;
US-Patent-Appl-SN-640457) Avail: US Patent Office CSCL 10B

A compact and electrolytically regenerative fuel cell with integral, but separate storage for the electrolyte and each of the gases utilized is described. The fuel cell embodies bipolar plates possessing integral manifold means for conveying the fuel and oxidizing gases to and from the storage areas of the cell. It also embodies gas distribution means in the plates for effective and uniform exposure of the electrodes and reacting areas to the fuel and oxidizing gases. During discharge of the cell, the stored gases are recombined at the electrodes. The same electrodes serve as the reacting surfaces for both the charge and discharge mode of operation. An extensible and contractable bellows assembly coacting between the storage equalizes the pressure between the gases in the storage area, thus reducing gas leakage and gas distribution problems. E.M.C.

N71-11053* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NON-MAGNETIC BATTERY CASE Patent
Thomas J. Hennigan, inventor (to NASA) Issued 1 Nov. 1966 (Filed 29 Oct. 1963) 4 p Cl. 136-132
(NASA-Case-XGS-00886; US-Patent-3,282,739;
US-Patent-Appl-SN-319894) Avail: US Patent Office CSCL 10C

A nonmagnetic hermetically sealed battery case formed of a nonmagnetic woven glass-type material impregnated with an epoxy resin is described for use with electrochemical cells in space vehicles and satellites. The case is able to withstand moderately high internal pressure (300 lbs/sq in.) with no clamping and achieves a weight saving of approximately 20% over conventional casings. It is corrosion resistant to electrolytes and has high shock resistance. Solid spiralled wires encapsulated in epoxy resin are used for terminal leads and the plastic enclosed cell is wrapped in epoxy resin saturated woven glass tape. Various views of the cell are included for different fabrication stages. J.M.

N71-11054# Tyco Labs., Waltham, Mass.
THE MECHANISMS OF THE ELECTROCHEMICAL REACTIONS OF SIMPLE ORGANIC COMPOUNDS IN AQUEOUS SOLUTIONS Final Technical Report, 1 May 1966 – 30 Apr. 1970
S. B. Brummer, A. H. Taylor, K. Cahill, R. D. Pearce, and S. Kirkland 30 Apr. 1970 25 p refs
(Contract N00014-66-C-0210)
(AD-711335) Avail: NTIS CSCL 7/4

Research to further the understanding of the anode of a hydrocarbon fuel cell is reported. Studies of simple organic reactions, e.g., the reduction of CO2, the oxidation of HCOOH, and the effects of adsorbed layers on their reactions in acid solutions are reported. Methods of determining the properties of adsorbate layers are experimentally and theoretically explored. Methods to allow determination of double layer charging effects and electrode oxidation corrections are developed. Studies of the Pt electrocatalytic surface show it to be markedly heterogeneous. Studies of the formation of reduced CO2, the main intermediate in hydrocarbon oxidation, have been carried out. The mechanism of HCOOH oxidation has been explored. It has been shown that the product of a side reaction blocks the electrode and inhibits the desired reaction. The electroactive species is apparently HCOO(-). The effects of adsorbed inorganic layers on HCOOH oxidation have been studied with a view to developing a non-noble metal catalyst stabilized by adsorption. Experiments with Cu, Ag, Pb, Hg, S, and Cl(-) are reported. The most reactive layers are Pb, Hg, and S. Author (TAB)

N71-11055* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
HEAT PIPE THERMIONIC DIODE POWER SYSTEM Patent
Ambrose W. Byrd, inventor (to NASA) Issued 28 Apr. 1970 (Filed 6 Sep. 1967) 5 p Cl. 310-4; Int. Cl. H01j
(NASA-Case-XMF-05843; US-Patent-3,509,386;
US-Patent-Appl-SN-666553) Avail: US Patent Office CSCL 10B

A power system utilizing a number of thermionic plasma diodes in parallel and heat pipes as cathodes is described. The diodes each contain a cathode which is integral to the heat pipe and which is heated by an isotopic heat source through the heat transfer function of the heat pipe. The system employs a circulatory cooling system, with a liquid metal as the coolant. R.B.

N71-11056* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLAR CELL SUBMODULE Patent
Robert K. Yasui, inventor (to NASA) Issued 3 Feb. 1970 (Filed 20 Apr. 1966) 5 p Cl. 136-89; Int. Cl. H01m Sponsored by NASA
(NASA-Case-XNP-05821; US-Patent-3,493,437;
US-Patent-Appl-SN-545223) Avail: US Patent Office CSCL 10B

Methods of constructing matrices of submodules for solar cells are described. The cells in each submodule are arranged in parallel and one terminal of each cell is connected near one end, with an undulative busbar having raised portions between the points of contact of the busbar with each of the cells. A second busbar, which includes a group of protruding tabs, is connected to each cell near the other end, with the tabs extending from it. After the cells forming each submodule are connected to the two busbars, the submodule includes the two bars as an integral part. The submodule may then be calibrated to determine its energy conversion characteristics. R.B.

N71-11057* TRW Equipment Labs., Cleveland, Ohio.
PULSED ENERGY POWER SYSTEM Patent
Benjamin Barish and Arthur R. Thomson, inventors, (to NASA) Issued 21 Apr. 1970 (Filed 14 Aug. 1968) 11 p Cl. 290-40; Int. Cl. E02n Continuation-in-part of US Patent Appl. SN-454439, Filed 10 May 1965 Sponsored by NASA
(NASA-Case-MSC-13112; US-Patent-3,508,070;
US-Patent-Appl-SN-765738) Avail: US Patent Office CSCL 10B

A power control system is described for cyclical application of combustible gases to a turbine which controls the operation of an ac voltage generator or related devices. The control system includes a valve which is turned on and off sequentially in response to the speed of the generator. R.B.

N71-11058* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTERCONNECTION OF SOLAR CELLS Patent
Joseph G. Haynos, inventor (to NASA) Issued 5 Aug. 1969 (Filed 13 Feb. 1964) 5 p Cl. 244-1; Int. Cl. B64c; Int. Cl. H02n; Int Cl. H01v
(NASA-Case-XGS-01475; US-Patent-3,459,391;
US-Patent-Appl-SN-344793) Avail: US Patent Office CSCL 10B

An improved solar cell mounting arrangement is described for use on space vehicles and satellites, applicable to mounting arrangements where barrier layer types (P/N or N/P junction) semiconductor cells are interconnected by means of expanded metal. A wide variety of configurations are possible including rigid and flexible structures that withstand thermal and vibrational shock. F.O.S.

N71-11059*# General Dynamics/Convair, San Diego.
SERVOACTUATOR STUDY FOR SPACE SHUTTLE APPLICATIONS
Gordon D. Smith Sep. 1970 144 p refs
(Contract NAS9-10367)
(NASA-CR-108686; GDC-DCB70-014) Avail: NTIS CSCL 13G

Designs and data to aid in the selection of aerodynamic surface control and thrust vector control servoactuator during the final definition phase of the space shuttle are presented. The study consisted of four basic activities: establishment of requirements, industry survey, conceptual designs, and tradeoff evaluation. Point design configurations were established for the flight control applications that had the greatest impact on vehicle interfaces. Parametric weight data was developed to provide trend information for those applications not specifically configured. The design configurations were to employ any type of power and control that represent current state-of-the-art technology. This included hydraulic, mechanical, electromechanical and gas servoactuator development. Additionally, the tradeoff included a digital configuration for comparison to the conventional analog type. The parameters used in the comparison evaluation were: weight, reliability, maintainability, checkout capability and cost. Weight was developed in quantitative form. The remainder of the parameters were in qualitative form to provide relative comparisons of the point designs. Author

N71-11060*# TRW Systems Group, Redondo Beach, Calif.
NIMBUS D LONG LIFE PNEUMATIC SUBSYSTEM Final Report
J. S. Tillotson 2 Jul. 1970 80 p
(Contract NAS5-10182)
(NASA-CR-111383; TRW-06158-R0-00;
TRW-06158-6002-R0-00) Avail: NTIS CSCL 13G

The design of the subsystem required a completely modular pneumatic system such that if a failure occurred prior to spacecraft integration to the launch vehicle, the complete subsystem could be replaced without breaking into the system to replace a component. The subsystem was also designed to provide sufficient torque so that the acquisition could be made from a separation tip-off rate of 5 deg/sec and the earth reference 180 deg out of phase. Freon 14 was selected as the expulsion gas because of its high mass and compression characteristics. After acquisition the pneumatic subsystem is to be used for unloading the roll and pitch momentum wheels. Author

N71-11061*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SERVOSYSTEM DESIGN OF A HIGH-RESPONSE SLOTTED-PLATE OVERBOARD BYPASS VALVE FOR A SUPERSONIC INLET
George H. Neiner Washington Nov. 1970 22 p refs
(NASA-TN-D-6081; E-5529) Avail: NTIS CSCL 10A

The valve utilizes a multislotted plate to achieve flow area change with minimum stroke and mass of moving parts. The servosystem utilizes a hydraulic piston-in-cylinder actuator close-coupled to a two-stage electrohydraulic servovalve. Using electronic compensation, the small-amplitude response of the system, modulating 14 percent of its full flow area, is flat within 0 to -3 db to 110Hz. Full valve flow area was 25 sq in. (161 sq cm). A mathematical model of the system is presented and analytical responses are compared with experimental data. Author

N71-11062 Oklahoma Univ., Norman.
CONCEPTUAL DESIGN OF A FIVE KW RADIOISOTOPE-FUELED POWER SYSTEM FOR TERRESTRIAL APPLICATIONS
Floyd Olan Calvert (Ph.D. Thesis) 1969 167 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 69-21979

The conceptual design study initially examines various possible dynamic power conversion systems including Brayton, Rankine, Stirling, and Feher power cycles. The direct Rankine cycle is selected for the design study on the basis of the pertinent criteria. Next considered are various possible working fluids for the power cycle. Steam and mercury are determined to be the best working fluids and power cycles are compared using these two fluids. Even though liquid metals are handicapped in terrestrial applications due to high condensing temperatures, it is shown that the liquid mercury cycle may be expected to have as high (or higher) a cycle efficiency as the steam cycle. This is due to the fact that the adiabatic expansion efficiency of the mercury turbine is greater than that for the small steam turbine. The radiosotope heat source subsystem design is considered in some detail and a particular cylindrical geometric arrangement using tungsten metal in the dual role of radiation shield and thermal conductor is recommended. Dissert. Abstr.

N71-11063# Royal Aircraft Establishment, Farnborough (England).
LARGE SOLAR ARRAY DEVELOPMENT IN UK
F. C. Treble Jan. 1969 28 p refs Presented at the 7th IEEE Photovoltaic Specialists Conf., Pasadena, Calif., 19-21 Nov. 1968
(RAE-TR-69007) Copyright. Avail: NTIS

Aspects of large solar array technology are reviewed, with particular reference to the development of an experimental 560 W deployable array. The array consists of very thin silicon solar cells mounted on Kapton polyimide film. It is stowed by folding the Kapton concertina fashion into rectangular compartments and deployed by pneumatically-actuated telescopic masts. Deployment is initiated by duplicated pyrotechnic actuators and takes about two minutes to complete. The estimated weight of the 78 sq ft array, including stowage compartments, cushioning, and deployment mechanism, is 25.2 lb, giving a power-weight ratio of 22.3 W/lb at 55 C. Author

N71-11064# General Electric Co., Pleasanton, Calif. Space Div.
THEORY OF THERMIONIC CONVERTER SURFACE PHENOMENA Final Summary Report
R. J. McCandless and D. R. Wilkins May 1970 122 p refs
(Contract N00014-69-C-0247)
(AD-711352; GESP-9015) Avail: NTIS CSCL 20/3

A theoretical model is developed with the objective of describing thermionic converter surfaces in terms of measurable crystallographic and atomic parameters. Emphasis is placed on the development of models applicable to uniform surfaces. Appropriate uniform surface work function data is selected for comparison with a computational model. The theoretical model is used to select surface characterization parameters that are readily measured and that can be related to the thermionic properties of the surface through the model. Thermionic converter data and a thermionic converter model are selected to permit a study of the relationship between work function and converter performance. The utility of bare work function as an index of converter performance is studied. Thermionic converter performance is strongly influenced by the thermionic properties of both the collector and emitter. The differences in thermionic properties of various emitters and collectors is attributed to the atomic and geometrical properties of the adsorbate and outer few substrate layers. Author (TAB)

N71-11065# Naval Ammunition Depot, Crane, Ind. Quality Evaluation Dept.
EVALUATION PROGRAM FOR SECONDARY SPACECRAFT CELLS. ACCEPTANCE TESTS OF GULTON INDUSTRIES 6.0 AMPERE-HOUR NICKEL-CADMIUM CELLS WITH GULTON PLATES
D. E. Christy 14 Aug. 1970 13 p
(AD-711594; QEIC-70-662) Avail: NTIS CSCL 10/3

The purpose of the acceptance test program was to insure that all cells put into the life cycle program are of high quality by the removal of cells found to have electrolyte leakage, internal shorts, low capacity, or inability of any cell to recover its open circuit voltage above 1.15 after the cell short test. Author (TAB)

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N71-11066*# Sandia Corp., Albuquerque, N. Mex. Planetary Quarantine Dept.
PLANETARY QUARANTINE PROGRAM Quarterly Progress Report, Period Ending 31 Mar. 1970
Mar. 1970 50 p refs
(NASA Order W-12853)
(NASA-CR-111386; QR-16) Avail: NTIS CSCL 06M

Research progress is reported on the following topics: (1) the effect of dry heat sterilization in bacterial spore inactivation modeling, (2) modeling of thermoradiation inactivation of spores, (3) a computerized identification scheme, (4) a general approach to estimating and predicting bioburdens, (5) the effectiveness of thermoradiation on inactivation of B. subtilis, (6) fabrication and testing of a microbiological air samples, and (7) spore inactivation by ultraviolet radiation. R.B.

N71-11067*# Stanford Univ., Calif. Dept. of Genetics.
SEARCH FOR PORPHYRINS IN LUNAR FINES FROM APOLLO 11 AND 12 Final Report
B. Halpern and G. W. Hodgson 15 Aug. 1970 133 p refs
(Contract NAS9-9439)
(NASA-CR-108671; SU-IRL-1111) Avail: NTIS CSCL 06A

Fluorescence spectrometry and analytical demetallation show that lunar fines from Apollo 11 and 12 samples contain porphyrin-like pigments. It is suggested that the pigments from samples close to the lunar landing modules are probably products of rocket combustion which were introduced during landing of the vehicles. Pigments were also found in lunar soil samples collected at a distance from the landing site. Fluorescent demetallation analysis indicates that the pigments were present as metal complexes, with an abundance estimated at 0.00005 microgram/g. Author

N71-11068# Battelle Memorial Inst., Columbus, Ohio.
ELECTRON MICROPROBE ANALYSIS OF ATMOSPHERE AEROSOLS Final Report

D. K. Landstrom and Doyle Kohler 31 Dec. 1969 52 p refs
(Contract PHS-CPA-22-69-33)
(PB-189282) Avail: NTIS CSCL 13B

The report describes a research effort to determine the feasibility and capability of electron microprobe analysis as a method for obtaining detailed compositional and structural information about pollutant aerosol particles in the atmosphere. Extensive data is presented from known test aerosols, automobile engine exhaust, and atmospheric samples. It was determined that the sampling method is presently the limiting factor in the detection and analysis of small particles, and, by preparing samples to minimize X-ray background, particles as small as 0.1 micron can be successfully analyzed. The theoretical limitations of the microprobe for both wavelength-dispersive and energy-dispersive spectrometers are discussed, and recommendations are made about analysis systems for small particles. Author (USGRDR)

N71-11069# National Air Pollution Control Administration, Raleigh, N.C.

CHARACTERISTICS OF PARTICULATE PATTERNS, 1957–1966

Robert Spirtas and Howard J. Levin Mar. 1970 105 p refs
(PB-192223; NAPCA-Pub-AP-61) Avail: NTIS CSCL 13B

Collected samples of suspended particulate matter since 1957 are considered. The resulting suspended particulate data are graphically summarized by the application of Whittaker–Henderson Type A curve-smoothing formulas to 10 years of data. Data from 60 urban stations and 20 nonurban stations were studied by this technique, which brings out the underlying cyclical patterns and long-term trends in nationwide levels of suspended particulate matter. Seasonal patterns are evident for many urban and nonurban stations, and the seasonal characteristics of the two types of stations contrast sharply. Long-term trends are downward at many center-city urban sites, but are upward at some nonurban sites. Author (USGRDR)

N71-11070# Washington Univ., Seattle. Dept. of Mechanical Engineering.

EVALUATING THE NOISES OF TRANSPORTATION: PROCEEDINGS OF A SYMPOSIUM ON ACCEPTABILITY CRITERIA FOR TRANSPORTATION NOISE

James D. Chalupnik, ed. Apr. 1970 401 p refs Conf. held at Seattle, 26–28 Mar. 1969
(Contract DOT-OS-A9-036)
(PB-191117; OST-ONA-70-2) Avail: NTIS CSCL 20A

Contents: Transportation noise sources; Scales for expressing noise level; Laboratory methods for evaluating human response to noise; Methods for evaluating community response to noise; Relation between laboratory results and community response. USGRDR

N71-11071# National Air Pollution Control Administration, Cincinnati, Ohio. Div. of Air Quality and Emission Data.

INTERSTATE EFFECTS SURVEILLANCE NETWORK: TABULATION OF DATA, JANUARY–DECEMBER 1969

May 1970 200 p
(PB-192446; NAPCA-APTD-70-3) Avail: NTIS CSCL 13B

Raw data are tabulated on air pollution effects on materials at 274 stations throughout the U.S. and in Ontario, Canada, for calender year 1969. The tables are titled: Station and Area Type Code; Effects Stations Identification List; Cumulative Frequency Distributions; Metal Corrosion; Dyed Fabrics; Silver Tarnishing; Lead Plates; Dustfall; Nylon Deterioration; Rubber Cracking; Sticky Paper (wind blown particulates); and Station Index (alphabetized by state). Author (USGRDR)

N71-11072# TRW Systems Group, Washington, D.C.

AIR QUALITY DISPLAY MODEL

Nov. 1969 187 p refs
(Contract PH-22-68-60)
(PB-189194) Avail: NTIS CSCL 13B

The Air Quality Display Model was developed for the computation of seasonal and annual concentration estimates. It is to be considered as a provisional dispersion model for estimating air quality until continuing research indicates an improved model is available. USGRDR

N71-11073*# Food and Drug Administration, Cincinnati, Ohio. Div. of Microbiology.

ECOLOGY AND THERMAL INACTIVATION OF MICROBES IN AND ON INTERPLANETARY SPACE VEHICLE COMPONENTS Quarterly Progress Report, 1 Jan.–31 Mar. 1970

R. B. Read, Jr. Jun. 1970 13 p ref
(NASA Order R-36-015-001)
(NASA-CR-111387; QPR-20) Avail: NTIS CSCL 06A

Thermal inactivation determinations of Bacillus subtilis var. niger spores at 125 C under 0.25 micrograms of water per ml of headspace air were analyzed for the ecology and thermal inactivation of microbes in and on interplanetary space vehicle components. An inactivation curve was established using experimental designs which statistically identified the within-run and between-run variations. Experiments using the same conditions except with 100 micrograms of water per ml of headspace air were also performed. Inactivation curves for B. subtilis var. niger spores at 125 C with 0.25 micrograms of water per ml headspace air when the spores were dried in distilled water were compared with similar data using phosphate buffer as the suspending fluid before drying. The dry-heat resistance of two strains of B. subtilis spores was established to have a high wet-heat resistance. J.M.

N71-11074# Bureau of Radiological Health, Rockville, Md.

REGULATIONS, STANDARDS, AND GUIDES FOR MICROWAVES, ULTRAVIOLET RADIATION, AND RADIATION FROM LASERS AND TELEVISION RECEIVERS: AN ANNOTATED BIBLIOGRAPHY

Lloyd R. Setter, David R. Snavely, Duane L. Solem, and Rodman F. Van Wye Apr. 1970 84 p refs *Its* PHS Publ. No. 999-RH-35
(PB-189360) Avail: NTIS CSCL 13L

This report is an annotated bibliography of guidelines, standards, and regulations pertaining to public health protection against electromagnetic radiation from television receivers, lasers, ultraviolet radiation, and microwaves. Each category of radiation is treated in a separate section. The annotated documents are designated as Class A (established or adopted by a governmental body acting under the authority of an act, law, or statute), Class B (adopted by consensus of a committee(s) or commission(s) of technical competence in standard-setting organizations), or Class C (not adopted by a standards-setting organization, but contains information pertinent to the preparation of suitable standards or regulations). The annotations include identification of the document, type of standard, intended compiler, intended benefitter, limits and specifications, and general guidance. Author (USGRDR)

N71-11075# Battelle-Northwest, Richland, Wash.

THE MEASUREMENT OF RADIATION EXPOSURE OF ASTRONAUTS BY RADIOCHEMICAL TECHNIQUES Quarterly Research Report, 5 Jan.–5 Apr. 1970

R. L. Brodzinski, L. A. Rancitelli, and W. A. Haller 15 Apr. 1970 27 p refs
(Contract AT(45-1)-1830)
(BNWL-1183-4) Avail: NTIS

The urine and feces specimens from the Apollo 12 mission were analyzed for their radionuclide content. Estimates of the cosmic radiation dose received by the astronauts were difficult to determine because of the decay of the short-lived radionuclides during quarantine; however, estimates of the dose to the Apollo 12 astronauts are similar to those received on the Apollo 7 and Apollo 9 missions. The concentrations of Be-7, Na-22, K-40, Fe-59, Co-60, and Cs-137 were determined. The radioactivity levels of

Be-7, Na-22, and Co-60 in both the urine and feces and the levels of K-40 and Fe-59 in the feces were comparable to those of previous missions. The Cs-137 concentration in the feces was lower than in previous missions, while the concentrations of K-40, Fe-59 and Cs-137 in the postflight urine specimens were higher than those observed in previous missions. No Pm-147 was observed in any of the samples. Author (NSA)

N71-11076*# Ocean Systems, Inc., Tarrytown, N.Y. Research and Development Lab.

RELATIVE DECOMPRESSION RISKS OF SPACECRAFT CABIN ATMOSPHERES

Gerald F. Doebbler and Robert W. Hamilton, Jr. Washington NASA Nov. 1970 66 p refs
(Contract NAS2-5481)
(NASA-CR-1694) Avail: NTIS CSCL 06S

The miniature pig was examined as a possible model for the study of altitude decompression sickness. With suitable qualifications, it is acceptable for use as a decompression model. It was necessary to separate hypoxic and decompression sickness symptoms by calibration of each animal. Rats were used to compare relative decompression risks after saturation with nitrogen, argon, neon, a neon-helium mixture, and helium. Neon and neon-helium were relatively less hazardous than even helium in terms of overall incidence of decompression sickness. Helium and neon-helium were least hazardous in terms of severe symptoms. Incidences of severe symptoms were similar for neon (21%) and argon (26%). With nitrogen and, to a lesser extent, argon, neon, and neon-helium, but not helium, a dependence of decompression sickness severity on body weight was observed. Weight must be controlled as a parameter when using rats to compare gas environments. Neon-helium and helium appear to be possible inert gas diluents to be considered most carefully in further large animal or manned studies of two gas space cabin atmospheres as these relate to decompression hazards. Author

N71-11077# Pennsylvania State Univ., University Park. Center for Air Environment Studies.

GUIDE TO RESEARCH IN AIR POLLUTION: PROJECTS ACTIVE IN CALENDAR YEAR 1969

Apr. 1970 198 p refs *Its* PHS Publ. No. 981; NAPC-Publ-AP-47
(Contract PHS-CPA-22-69-37)
(PB-192220) Avail: SOD $1.50; NTIS CSCL 13B

Information about 1383 projects active in calendar year 1969 was compiled from respondents to a questionnaire. The compilation has three main parts. (1) The project listing for United States projects are arranged alphabetically by States, and for foreign projects they are arranged alphabetically by country. Within each geographic location, the listing is further alphabetized by performing organization. Each entry also includes the project title, name of the investigator and address, the sponsor, and the type of support. The entries are numbered sequentially with project numbers. (2) The categorical listing or subject index, is arranged alphabetically by 19 subject categories. Within each category, the listing is further alphabetized by project title. Following each project title, its project number appears. (3) The principal investigator listing or index is arranged alphabetically. Following each investigator's name, the project number and citations of publications and presentations resulting from the project appear. Author (USGRDR)

N71-11078# Clearing House for Federal Scientific and Technical Information, Springfield, Va.

ENVIRONMENTAL POLLUTION: A SELECTED BIBLIOGRAPHY. INFORMATION FOR BUSINESS AND INDUSTRY, REPORT FOR JANUARY 1968 – APRIL 1970

May 1970 37 p refs
(OB-192318; NTIS-BIB-70-01) Avail: NTIS CSCL 13B

The document is a selective bibliography of 333 references pertaining to the causes, detection, and control of air and water pollution including noise, pesticides, population, wastes, oil, radioactivity, sulfur oxides, engine exhausts, and temperature. Author (USGRDR)

N71-11079# Advanced Metals Research Corp., Burlington, Mass.

ELECTRON MICROPROBE X-RAY ANALYSIS OF ATMOSPHERIC AEROSOL PARTICLES, 1 DECEMBER 1968 – 31 AUGUST 1969

31 Aug. 1969 85 p refs
(Contract PHS-CPA-22-69-26)
(PB-189283) Avail: NTIS CSCL 13B

Electron microprobe analysis was applied to the chemical identification of the airborne particles characteristic of air pollution contaminants. A conventional AMR electron microprobe and a Philips EM200 electron microscope equipped with an AMR X-ray spectrometer attachment were employed to investigate size-fractioned samples of laboratory generated aerosol particles of NaCl and Zn (NH4)2 (SO4)2, as well as specific pollution sources, e.g. Los Angeles smog and auto exhaust. The effect of instrument variables, including electron beam size, acceleration potential, and beam current was determined for particles ranging in size from 3 to 0.5 microns. X-ray spectral patterns obtained from Los Angeles smog particles are presented and limitations in the analytical technique are also discussed. Scanning electron microscopy was employed as a supplement to conventional electron microscopy. Author (USGRDR)

N71-11080# Food and Drug Administration, Washington, D.C.

INTERBUREAU BY-LINES, VOLUME 6, NO. 4

John P. Erickson, Michael Gruenfeld, George Wilamowski, Thomas L. Barry, and Jane Kaminski Jan. 1970 55 p refs
(PB-189204) Avail: NTIS CSCL 06O

Contents: Study of bacterial growth in a mouthwash containing a preservative; Separation of some solvent mixtures on several GLC columns; Spectrophotometric method for determination of diiodohydroxyquin in drugs; Combined GLC-mass spectrometry; and Spectra of colors. USGRDR

N71-11081# Atomics International, Canoga Park, Calif.

RADIATION CHEMISTRY OF CHROMOSOMES Final Report, 1 Jul. 1969 – 27 Jun. 1970

M. D. Sevilla 27 Jun. 1970 122 p refs
(Contract AT(04-3)-701)
(AI-AEC-12974) Avail: NTIS

The effects of ionizing radiation on chromosomes and chromosome constituents were investigated. This work concentrated on the reactions of radical intermediates produced by ionizing radiation with chromosome constituents. Reactions of hydrogen atoms and electrons with these constituents were investigated previously. Studies of reactions of electrons with chromosome constituents were continued with an investigation of peptides, pyrimidines, and nucleosides. The electrons were photolytically generated in an alkaline D2O glass and allowed to react with the peptide solute; the radicals produced were identified by means of ESR spectroscopy. This work suggests that in the chromosome positive ions or holes formed in the DNA during radiolysis would localize unpaired spins on thymidine by production of R-CH2 · radicals. A study of the radiolysis of frozen aqueous solutions of DNA suggests that the thymidine anions formed by electron attachment protonate at the C6 position to form the usual thymyl radical. Author (NSA)

N71-11082# Pittsburgh Univ., Pa.

EFFECTS OF CERTAIN COMPOUNDS ON ANIMALS SUBJECTED TO SIMULATED HIGH ALTITUDE Final Report, 20 Oct. 1969 – 31 Jul. 1970

Joseph P. Buckley, Herbert Barry, III, and Souheir El Masry Aug. 1970 27 p refs

(Contract DADA17-67-C-7089)
(AD-711554; Rept-3) Avail: NTIS CSCL 6/15

There was a 50% reduction in hepatic glycogen content of male Wistar rats treated with phenformin hydrochloride, 100 mg/kg, or decompressed for 4 hours at 24,000 feet. There was also an increase in the glycogen content of the heart and diaphragm of the decompressed animals. There was a 5-fold increase in the myocardial glycogen content of rats treated with phenformin for 7 days as well as a marked increase in glycogen content in both the liver and diaphragm. Blood lactate increased approximately 3-fold following phenformin treatment and approximately 8-fold after a single dose of phenformin plus 4 hours of decompression. The data suggest that prolonged treatment with phenformin enhances the efficiency of recycling carbohydrate under anaerobic conditions and increases utilization of carbohydrate at the expense of lipid stores. Author (TAB)

N71-11083 Iowa Univ., Iowa City.

A METHOD FOR THE KINEMATIC ANALYSIS OF AN INACCESSIBLE THREE-DIMENSIONAL MECHANISM FOR APPLICATION TO HUMAN SKELETAL KINESIOLOGY

Ernest Byron Marsolais (Ph.D. Thesis) 1969 122 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-21709

The problem becomes that of determining the position of a concealed three-dimensional link relative to a former position and the solution requires the combination of several techniques. There are three major divisions in this problem. First, a method is found for observing the link in the initial and final positions. Following this, a method for quantitative comparison of the shape of the unknown projection with that of the projections of selected nearby known positions is found, and finally, a method for choosing the best matching projections is developed. An asymmetric metal model is used for illustration but a parallel development of the method for the scaphoid bone of the wrist joint is included. The basic assumption necessary in the analysis is that each link in the mechanism has no plane of symmetry and that any projection of each link is thus unique. It is further held that from the past anatomical investigations, gross translational and rotational limits may be assumed. Dissert. Abstr.

N71-11084 Northwestern Univ., Evanston, Ill.

ANALYSIS AND MEASUREMENT OF HUMAN TORSIONAL EYE MOVEMENTS

Andrew Endre Imre Kertesz (Ph.D. Thesis) 1969 84 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 70-87

An objective method was developed to measure the time course of torsional eye movements about the line of sight. The resolution of the system was better than 1/2 deg. Torsional movements of one eye monocularly fixating the center of a rotating sectored disc were measured. The eye rotated in the same direction as the disc did, and attained a fairly constant angular deflection over the range of 2 to 28 rpm. Superimposed upon this deflection, nystagmus-like movements were sometimes observed. Using only an annular portion of the disc, it was found that the eye deflection exhibited a peak at 17 rpm, which was not apparent when the entire disc was viewed. Experiments with a disc of fewer sectors suggested that the response was proportional to the number of receptors exposed to the moving boundaries contained in the stimulus and that some form of spatial summation of receptor responses takes place. The response of retinal receptors and higher order sensory neurons as a function of stimulus velocity was computed from experimental data using a postulated linear model. Dissert. Abstr.

N71-11085# School of Aerospace Medicine, Brooks AFB, Tex.

LECTURES IN AEROSPACE MEDICINE, 9-12 FEBRUARY 1970, SEVENTH SERIES

1970 498 p refs
(AD-711792; SAM-TR-70-229) Avail: NTIS CSCL 6/11

Contents: Ultraviolet radiant energy and the eye; Visual performance decrements in aerospace operations; Vision toward the ground from the cockpits of selected tactical aircraft; Silent myocardial infarction in USAF flyers detected solely by annual required electrocardiogram; Tolerance limits to acute hypercarbia under normobaric and hypobaric conditions; Toxicological evaluation of carbon monoxide in humans and other mammalian species; Performance decrement in nonhuman primate decompression exposures; Review of motion sickness of patients referred to the USAF School of Aerospace Medicine; Microbiological aspects of aeromedical evacuation; Alteration of drug action and metabolism under reduced pressure; Human cytogenetics and aerospace environments; Environmental pharmacology; and An evaluation of human restraint systems during-Gx impact. TAB

N71-11086# Naval Air Development Center, Johnsville, Pa. Aerospace Crew Equipment Dept.

RESPIRATION SYSTEM HEAT EXCHANGE WITH EMPHASIS ON THE TRACHEAL REGION Interim Report

Stephen L. Gordon 1 Jul. 1970 90 p refs
(AD-711844; NADC-AC-7008) Avail: NTIS CSCL 6/16

In order to measure details of respiratory heat exchange in the trachea of the dog, temperature probes with three sensors were positioned at four axial locations. The recorded inspiration temperatures, in conjunction with the assumed symmetrical nature of the flow, produced inspiratory temperature profiles for various respiration conditions and various gases. Based upon measurements obtained from three of the dogs, tracheal inspiration profiles show undeveloped entrance conditions and the developing nature of the flow along the axial direction. Tracheal wall probes indicate a cooler than body core temperature condition, which could effect the cooling of expired gases returning from the warmer lung region. Dry air and helium gas tests produced similar results. Saturated air tests indicated a lesser mid-stream to wall temperature differential, which is believed to be a result of coupling effects between the energy and mass transfer equations. Author (TAB)

N71-11087*# SysteMed Corp., Dayton, Ohio.

TOXIC HAZARDS RESEARCH UNIT ANNUAL TECHNICAL REPORT, 1969 Final Report, Jun. 1968 – May 1969

J. D. MacEwen and E. H. Vernot Sep. 1969 60 p refs
Supported in part by NASA
(Contract F33615-67-C-1025)
(NASA-CR-111394; AD-699594; W-69006; AMRL-TR-69-84; AR-5) Avail: NTIS CSCL 06T

The activities of the Toxic Hazards Research Unit (THRU) are reviewed in this report. The experimental research program was conducted concurrently with construction activities for additional facilities. The construction activities did not stop the research program but required cooperative scheduling of both activities to permit installation of utilities without interruption of experimentation. At scheduled periods, experiments were suspended to permit major corrective and preventive maintenance programs on both the ambient and altitude laboratory facilities. The Apollo materials toxicity screening tests have continued with no further evidence of toxicity exhibited by their gas-off products. A repeat eight-month study of the effects of a mixed gas (oxygen-nitrogen) atmosphere at 5 psia was completed with the only confirmed adverse effect being the depressed growth of albino rats. Experiments conducted in the ambient facility included studies on the effects of ethylene glycol vapor on rodents, studies on emergency exposure limits for monomethylhydrazine (MMH) and nitrogen trifluoride (NF3), and preliminary acute toxicity experiments on oxygen difluoride (OF2) and chlorine trifluoride (ClF3). Author (TAB)

N71-11088# Armed Forces Radiobiology Research Inst., Bethesda, Md.

THE EFFECTS OF 15,000 RADS PULSED GAMMA-NEUTRON RADIATION ON THE BEHAVIORAL PERFORMANCE OF MONKEYS (MACACA MULATTA)

R. W. Young and W. L. McFarland Jun. 1970 15 p refs
(AD-712054; AFRRI-SR70-7) Avail: NTIS CSCL 6/18

Seven male monkeys trained to a visual discrimination task were exposed to a pulsed 15,000-rad midline tissue dose of gamma-neutron radiation. Of these seven animals, five were unable to perform within 5 minutes postirradiation and remained in a state of total nonperformance until death. The two remaining animals experienced periods of severe performance decrement followed by a return of performance capability which approached the preirradiation value. This performance capability deteriorated rapidly at 58 and 88 minutes postirradiation in these two animals, after which time the subjects failed to perform until death. The median survival time for all animals was 1 hour and 18 minutes.
Author (TAB)

N71-11089# Tokyo Medical and Dental Univ. (Japan). Dept. of Physiology.
THE INHIBITORY AND ACCELERATORY SYNAPSES IN A CRUSTACEAN HEART GANGLION Final Report, 23 Dec. 1965 – 30 Jun. 1970
Akira Watanabe APO San Francisco, Calif. ARDG (FE) Jun. 1970 29 p refs
(Contract DA-CRD-AG-S92-544-66-G3)
(AD-711971; ARDG(FE)-J-227-1; Rept-1) Avail: NTIS CSCL 6/16

The purpose of the research is to elucidate the mechanism of inhibition and acceleration at the synapse in the nervous system. The heart ganglion of astomatopod Crustacea supplies an excellent material for the study. The inhibitory and acceleratory axons are stimulated, and the potential changes are recorded from the postsynaptic cells with intercellular microelectrodes. It is concluded that the acceleratory effect is not mediated by the excitatory postsynaptic potential EPSP but is due to a direct action of the transmitter in the pacemaker membrance.
Author (TAB)

N71-11090# Boston State Hospital, Mass. Sleep and Dream Lab.
A STUDY OF LONG AND SHORT SLEEPERS Final Report
Ernest Hartmann and Geogre Zwilling 14 Jul. 1970 77 p refs
(Contract DADA-17-67-C-7115)
(AD-711579) Avail: NTIS CSCL 5/10

Adult males who always sleep less than six hours or more than nine hours per day were studied. Over 400 were screened; smaller numbers had various psychological tests and psychiatric interviews, and finally 29, free of overt medical or psychiatric pathology, were studied in the laboratory for 8 nights each of all-night polygraphic recording. Psychologically the short sleepers were efficient, hard-working, and somewhat hypomanic. The long sleepers tended to be anxious, depressed, or withdrawn. The two groups spent an almost identical amount of time -- 75 minutes -- in deep slow-wave sleep (stages 3-4), but the long sleepers had twice as much D-time (REM-time). It is suggested that there are two separate sleep requirements, a requirement for stage 3-4 sleep which is relatively constant across persons, and a requirement for D-time which is related to the personality and life-style of the individual.
Author (TAB)

N71-11091*# Aerojet-General Corp., El Monte, Calif. Medical and Biological Systems.
DEVELOPMENT OF TECHNIQUES AND REAGENTS FOR ASSESSMENT OF VIRAL ECOLOGY Final Report
30 Sep. 1970 119 p
(Contract NAS9-9740)
(NASA-CR-108687) Avail: NTIS CSCL 06F

The feasibility of the Passive Immunological Agglutination (PIA) system was examined using a myxovirus, adenovirus, echovirus, herpesvirus, coxsackievirus and one mycoplasma species. The sensitivity of the PIA technique was compared with conventional assay techniques for detecting the presence of infective organisms. With the exception of the mycoplasma, the PIA system was shown to be up to 100 times as sensitive as the conventional assay system with a response time of 1-2 hours versus 2-14 days for the conventional methods. The production of high titered antibody and its subsequent attachment to polystyrene latex particles has increased the sensitivity of the PIA test for mycoplasma from 500 cfu/ml to 100 cfu/ml. Different readout systems were examined during the course of the program. Three systems appeared most conducive to automating the readout: (1) an electronic particle connector; (2) a light scattering system; and (3) a microscope video computer system.
Author

N71-11092*# School of Aerospace Medicine, Brooks AFB, Tex. Aerospace Medical Div.
DETERMINATION OF SURFACE TENSION IN BIOLOGIC FLUIDS
Leopoldo L. Rodriguez, Kenneth G. Ikels, and J. Ryan Neville Dec. 1969 9 p refs
(NASA Order T-82170)
(NASA-CR-11132; AD-700755; SAM-TR-69-89) Avail: NTIS CSCL 06C

Determination of meaningful surface tension in biologic fluids poses numerous problems because of the presence of diverse solutes and surface-active agents and the spontaneous changes of the exposed surface. During the course of an investigation of decompression sickness, particularly the biophysical basis of bubble formation, it became desirable to measure surface tension in samples of human blood in order to evaluate the effect that differences in surface tension might have on susceptibility to decompression sickness. A device was developed that utilizes a horizontally placed capillary tube of 1 mm. or less I.D. into which a sample of approximately 10 microliters or less is placed. After forcing the liquid to the end of the capillary tube, the pressure required to flatten the meniscus is measured. Conductive properties of the sample are used to determine the pressure end point. The instrument permits reproducible measurements (plus or minus 1 dyne/cm) to be made rapidly (less than 1 min) on small quantities of fluid.
Author (TAB)

N71-11093# Northrop Corp Silver Spring, Md. Electro-Mechanical Div.
REPORT OF EXPERIMENTAL DIVES FOR ADS-4: DECOMPRESSION SCHEDULES
M. N. Kahn and J. K. Summitt Washington Navy Exptl. Diving Unit 26 Aug. 1970 115 p ref
(Contract N00024-70-C-5558)
(AD-711842; NEDU-RR-4-70) Avail: NTIS CSCL 6/19

The report provides a detailed description of the developmental decompression schedules tested for use with the Advanced Diving System (ADS) IV. The evolution of the developmental schedules into the final decompression schedules is presented. A brief description of facilities and procedures used in performing these dives is also provided. The report is based on an analysis of the diving logs of 121 dives over the period March 1967 through May 1968, personnel interviews with divers, and Navy records.
Author (TAB)

N71-11094*# Yeshiva Univ., New York.
A STUDY OF THE STABILITY OF SLEEP PATTERNS IN YOUNG ADULTS FOR SEQUENTIAL NIGHTS OVER A THREE WEEK PERIOD Final Report, 15 Jun. 1968 – 15 Jun. 1970
Elliot D. Weitzman 15 Jun. 1970 27 p refs
(Grant NGR-33-023-032)
(NASA-CR-111519) Avail: NTIS CSCL 06P

In the study reported each subject had a three week baseline nocturnal sleep period, followed by three weeks of sleep during the day, followed by a re-inversion period of three weeks sleeping at right. The data obtained from these studies are described.
Author

N71-11095# Naval Submarine Medical Center, Groton, Conn. Submarine Medical Research Lab.

THE HILL'S ALTERNATIVE TO NAVAL DECOMPRESSION CONCEPTS: A CRITICAL VIEW

Ruport Hester 24 Mar. 1970 55 p refs
(AD-711809; SMRL-620) Avail: NTIS CSCL 6/19

The approach by Hills is based upon two hypotheses: (1) inert gas transport is limited by diffusion in a single radial model of extra-vascular tissue, and (2) nucleation and phase equilibration between dissolved gas and gas in silent bubbles may preclude supersaturation in excess of 74 mmHg. Actually, two different models, not always clearly distinguished, are presented. One, expounded in theoretical analysis is concerned with gas concentration in a certain average sense over the extra-vascular space. The other, used for his proposed optimum decompression method presumes a restraint on point tensions to 74 mmHg over the diffusion field is necessary to preclude nucleation. Author (TAB)

N71-11096 Pennsylvania State Univ., University Park.

HUMAN GROWTH, PHYSIQUE, AND PULMONARY FUNCTION AT HIGH ALTITUDE: A FIELD STUDY OF A PERUVIAN QUECHUA POPULATION

Andres Roberto Frisancho (Ph.D. Thesis) 1969 177 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 70-670

The potential effect of low partial pressure of oxygen and the concomitant reduction in oxygen availability or hypoxia on the growth and development of men at high altitude was studied. The mean barometric pressure at 4267 meters was 446.4 mm/Hg with an oxygen partial pressure of 93.6 mm; at this altitude there is about a 32 percent reduction in the partial pressure of oxygen. The cross-sectional sample consisted of 1,152 subjects of which 702 were males and 450 females, aged two to 22 years. The samples were measured by anthropometric and roentgenogrametric techniques. The interrelationship between measurements of pulmonary function and body morphology was analyzed through correlation and multivariate regression equation techniques. It is suggested that the slower and prolonged physical growth of the Nunoa Quechua children is probably related to the effects of hypoxic stress of high altitude, while the greater chest size and higher forced expiratory lung volumes reflect the developmental adaptive response to altitude hypoxia. Dissert. Abstr.

N71-11097 Illinois Univ., Urbana.

THE EFFECT OF LOW BAROMETRIC PRESSURE ON HUMAN AND CHICKEN RBC ACTIVE SODIUM EFFLUX

Joel Langdon Mattsson (Ph.D. Thesis) 1969 81 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 70-924

The transport model selected was active Na-22 extrusion by human and chicken erythrocytes. Since the human RBC differs from other cells of the body in not needing oxygen for metabolism, the chicken nucleared erythrocyte was also employed because it does depend on oxygen for energy metabolism. Erythrocyte Na-22 extrusion was measured at barometric pressures of 760 and 130 mm Hg, in samples that contained the active transport inhibitor oubain and in samples that were oubain-free. The Na-22 extruded from oubain-free samples was considered to be total efflux, and that from oubain treated cells as passive efflux. The difference between total and passive efflux was taken to be active efflux. Data accumulated during the pilot studies of low pressure effects on active transport showed that lowering the partial pressure of oxygen caused an increase in passive sodium influx and efflux, the effect being more marked in chicken than in human erythrocytes. The results of the experiments indicated that acute exposure to barometric pressures utilized in aerospace programs are not detrimental to human or chicken RBC active cation transport. Dissert. Abstr.

N71-11098# Army Medical Research and Nutrition Lab., Denver, Colo. Fitzsimons General Hospital.

EFFECTS OF DIET AND ALTITUDE ON THE BODY COMPOSITION OF RATS

Kenneth S. K. Chinn and John P. Hannon Repr. From J. Nutr., v. 100, no. 7, Jul. 1970 p 732–738 refs
(AD-712239) Avail: NTIS CSCL 6/19

The body composition of growing albino rats maintained on diets high in carbohydrate, fat or protein was studied at Denver 5,280 feet and climax 11,400 feet, Colorado. The higher altitude has no significant effect on growth rate. It did, however, lead to decreased body fat deposition under all three of the dietary conditions. At both elevations rats receiving a high fat diet accumulated more body fat than those receiving carbohydrate or protein diets. Altitude did not affect the fat-free body mass, but a calculated shift of protein from muscle to nonmuscle tissue was observed in the animals at climax. The effect of diet on the relative amount of estimated muscle protein at both elevations was in the following order protein carbohydrate fat. Although total body water from the extra- to the intracellular space was observed. Author (TAB)

N71-11099# Army Medical Research and Nutrition Lab., Denver, Colo. Fitzsimons General Hospital.

THIAMINE METABOLISM IN MAN

M. R. Ariaey-Nejad, M. Balagni, E. M. Baker, and H. E. Sauberlich Repr. From Amer. J. Clin. Nutr., v. 23, no. 6, Jun. 1970 p 764–778 refs
(AD-712238) Avail: NTIS CSCL 6/16

The metabolism of 2-14 C-thiazole-labeled thiamin and 2-14 C-pyrimidine-labeled thiamin was studied in four healthy young adult men. The orally administered labeled thiamin was almost completely absorbed with no measurable amount of 14 CO2 detected in the respiratory air. The half excretion time of the ingested label occurred within 9 1/2 -18 1/2 days and appeared to be related to the weight of the subject and the daily dietary intake of thiamin. Four radioactive peaks were obtained from the urine of three subjects who has ingested 2-14 C-thiazole-labeled thiamin and three peaks from the urine of subject who has received 2-14 C-pyrimidine-labeled thiamin. Approximately 50% of the thiamin activity present in the urine was thus found due to metabolites other than that of free thiamin. One of the major urinary metabolites of 2-14 C-thiazole-labeled thiamin was positively identified as 4-methylthiazole-5-acetic acid. Also the thiazole moiety of thiami and thiamin. One of the major urinary metabolites of thiamin, which contained both the pyrimidine and the thiazole moieties, appeared to be a conjugation of thiamin or a derivative with a peptide moiety. Author (TAB)

N71-11100# National Air Pollution Control Administration, Washington, D.C.

CONSULTATION ON THE PHOENIX-TUCSON INTRASTATE AIR QUALITY CONTROL REGION (ARIZONA)

Sep. 1969 58 p refs
Avail: Issuing Activity

Air pollution as a regional problem is studied in southern Arizona, including the Phoenix and Tucson metropolitan areas (designated the Phoenix-Tucson Intrastate Air Quality Control Region by the Department of Health, Education and Welfare). Topological factors, pollutant emissions, and meteorological factors are discussed. F.O.S.

N71-11101 Pennsylvania Univ., Philadelphia.

STUDIES OF THE TOXIC EFFECTS OF OXYGEN AT ONE ATMOSPHERE ON TISSUE METABOLISM IN VITRO

Carolyn Diane Williams (Ph.D. Thesis) 1969 161 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 69-21469

The mechanisms by which oxygen produces toxic effects on cellular metabolism was investigated. Several metabolic systems were studied in vitro including glycolysis, the tricarboxylic acid cycle and reactions of isolated mitochondria. Oxygen increases latent mitochondrial ATP-ase activity. This toxic effect of oxygen is potentiated by either ferrous or cupric ions. The action of Fe(++) may be related to a stimulation of lipid peroxidation while that of Cu(++) may involve the oxidation of sulfhydryl groups. Oligomycin, an inhibitor of oxidative phosphorylation reverses the stimulation of ATP-ase activity produced by oxygen. Since oligomycin also inhibits DNP-stimulated ATP-ase activity, it is possible that oxygen and DNP act at the same step in oxidative phosphorylation. Dissert. Abstr.

N71-11102# Army Medical Research and Nutrition Lab., Denver, Colo.
SUBJECTIVE SYMPTOMATOLOGY AND COGNITIVE PERFORMANCE AT HIGH ALTITUDE
David A. Stamper, Robert A. Kinsman, and Wayne O. Evans Repr. from Percept. Motor Skills, no. 31, 1970 p 247–261 refs Prepared in cooperation with Army Res. Inst. of Environ. Med.
(AD-712182) Avail: Copyright. NTIS CSCL 6/16

Further standardization of the General High Altitude Questionnaire GHAQ for use in quantifying the severity of acute mountain sickness is described. The results are related to changes in symptom severity. The amount of decrement on a number of psychomotor tasks is related to the degree of severity of the subjective symptomatology of acute mountain sickness. The results also are related to several conceptually clear symptom clusters of the GHAQ that appear to reflect different states of subjective symptomatology. Author (TAB)

N71-11103# Aerospace Medical Div. Aeromedical Research Lab. (6571ST), Holloman AFB, N. Mex.
CIRCULATORY IMPAIRMENT DURING EXPOSURE TO AMBIENT PRESSURES OF 4 mm Hg and 55 mm Hg
Alfred J. Pratt, Hubert L. Stone, Hugh F. Stegall, and William C. Kaufman Repr. from J. Appl. Physiol., v. 29, no. 2, Aug. 1970 p 177–180 refs Prepared in cooperation with AFSC, Brook AFB, Tex.
(AD-712188; ARL-TR-70-16) Avail: NTIS CSCL 6/19

The extent that the circulation is impaired under near vacuum conditions was investigated in five anesthetized dogs and one anesthetized chimpanzee decompressed from 380 mm Hg to 4 mm Hg in 1-2 sec and maintained at 4 mm Hg for 60 sec. Blood flow velocity, measured within the thoracic aorta with a catheter-tip Doppler flowmeter, severely decreased in dogs within 30 sec and approximated cessation in the chimpanzee after 10 sec. Aortic and vena caval pressures tended to equalize in dogs equilibrium and subsequent pressure gradient inversion resulted in the chimpanzee. Mechanical events associated with gas expansion and especially water vaporization were believed largely responsible for these effects. Anoxi bradycardia, similar in both species, ensued also. Anoxic anoxia, uncomplicated by water vaporization after decompression from 431 mm Hg to 5 mm Hg, failed to seriously impair cardiovascular function in dogs, but apparently was accompanies in the chimpanzee by mechanical events from gas expansion sufficient to block the circulation. Differences in responses in these two species probably involved the physical characteristics of the torso. Author (TAB)

N71-11104 California Univ., San Diego.
THE MECHANISM OF HYDROGEN EVOLUTION BY ALGAE
Frederick Patrick Healey (Ph.D. Thesis) 1969 146 p
Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 70-1040

During the present study, H2 evolution has been observed only in species of Chlamydomonas, Chlorella, and Scenedesmus. Based primarily on the response of photoevolution of H2 to DCMU, it appears that algae can obtain reductant for the photoevolution of H2 from either the oxidation of organics or the photooxidation of H2O, or from both these sources. Dissert. Abstr.

N71-11105# Joint Publications Research Service, Washington, D.C.
BIOMEDICAL PROBLEMS OF SPACE FLIGHT
Yu. G. Grigoryev, et al 28 Oct. 1970 335 p refs Transl. into ENGLISH from Russian reports
(JPRS-51660) Avail: NTIS

Conference papers are presented on space-oriented microbiology, physiology, biochemistry, pharmacology, radiobiology, bioengineering, psychology, and related topics. N.E.N.

N71-11106# National Air Pollution Control Administration. Washington, D.C. Div. of Abatement.
CHATTANOOGA INTERSTATE AIR QUALITY CONTROL REGION
Robert S. Russo Jun. 1970 13 p refs
Avail: Issuing Activity

A schematic map of the Chattanooga interstate quality control region is presented, along with data tables on (1) fuel usage and refuse disposal for Federal facilities, (2) annual fuel consumption of Federal facilities, (3) Federal contribution to air pollution, (4) Federal point sources, and (5) abatement program for Federal problem areas. A volunteer army ammunition plant in Hamilton County, Tennessee is briefly discussed. J.A.M.

N71-11107*# Techtran Corp., Glen Burnie, Md.
STUDIES OF THE SULPHUR-MAT FORMATION AND THE SULPHUR BACTERIA OF THE HOT MINERAL SPRINGS OF YUMOTO NEAR NIKKO [STUDIEN UEBER DIE SCHWEFELRASENBILDUNG UND DIE SCHWE-ELBACTERIEN DER THERMEN VON YUMOTO BEI NIKKO]
M. Miyoshi Washington NASA Nov. 1970 31 p refs Transl. into ENGLISH of J. of the Faculty of Sci., Imperial Univ. of Tokyo, v. 10, 1897 p 143–173
(Contract NASw-2037)
(NASA-TT-F-12738) Avail: NTIS CSCL 06M

A detailed description of the formation is given, including water temperature and currents data. The bacteria responsible for the formation, divided into colorless and colored varieties, are carefully enumerated and described. Laboratory experiments relating to the chemotactic sensitivities of Chromatium weissii, one of the colored varieties are described. The organism is also found to be sensitive to tactile stimuli. Author

N71-11108# National Air Pollution Control Administration. Washington, D.C. Div. of Abatement.
METROPOLITAN BALTIMORE INTRASTATE AIR QUALITY CONTROL REGION
L. L. Nagel Feb. 1970 29 p refs
Avail: Issuing Activity

The current status is presented of the federal facilities in the region with regard to implementation of the objectives prescribed by the Clean Air Act. Quantitative data on fuel burning and refuse disposal practices, air pollutant emissions, and abatement plans are included. Author

N71-11109# National Air Pollution Control Administration, Washington, D.C.
CONSULTATION ON THE METROPOLITAN DETROIT-PORT HURON INTRASTATE AIR QUALITY CONTROL REGION
Oct. 1969 53 p refs
Avail: Issuing Activity

A proposal for the boundaries of the metropolitan Detroit-Port Huron intrastate air and quality control region is presented along with the urban and engineering factors evaluations supporting the proposal. The urban factors evaluation consists of a review of existing governmental jurisdictions, current air pollution control programs, demographic data, current urbanization, and projected patterns of urbanization. The engineering factors evaluation considers pollutant source locations, emissions, and the geographic extent of air pollutant concentrations in the ambient air. D.L.G.

N71-11110# Joint Publications Research Service, Washington, D.C.

HYPERBARIC EPILEPSY AND NARCOSIS

4 Nov. 1970 93 p refs Transl. into ENGLISH from the book 'Giperbaricheskiye Epilepsiya i Narkoz' Leningrad, 1968 p 3–5, 139–185, and 243–249
(JPRS-51714) Avail: NTIS

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4. DYNAMICS OF MANIFESTATIONS OF HYPERBARIC NARCOSIS IN MAN DURING EXPOSURE TO CONSTANT PRESSURE Z. S. Gusinskiy et al p 44–53 refs (See N71-11114 02-04)
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6. GENERAL FEATURES OF EPILEPTIC AND NARCOTIC TYPES OF CENTRAL NERVOUS SYSTEM BREAKDOWN G. L. Zaltsman p 67–75 refs (See N71-11116 02-04)

N71-11111# Joint Publications Research Service, Washington, D.C.

DATA ON THE NARCOTIC EFFECT OF INCREASED PRESSURES OF NITROGEN, ARGON, AND HELIUM ON MAN

V. V. Smolin et al *In its* Hyperbaric Epilepsy and Narcosis 4 Nov. 1970 p 5–25 refs (See N71-11110 02-04)
Avail: NTIS

The investigations were conducted in a recompression chamber in which the pressure was increased with compressed air. The test subjects were placed in the apparatus and breathed a mixture of oxygen and one of the inert gases. A multichannel electroencephalograph and a special device for study of conditioned reflex activity were used in the experiments. The studies show that initial shifts and disorders of higher nervous activity and EEG changes have a unidirectional character and are regularly intensified with an increase of pressure. The effect of increased nitrogen and argon pressures on the following disorders of higher nervous activity are: reduced ability to do intellectual work, disorder of the fine coordination of hand movements, weakening of memory and attention span, changes in conditioned reflex motor activity, and reduction in distinction of auditory signal frequency. Changes in EEG patterns were revealed in a reduction of the amplitude and index of the alpha-rhythm and an increase in its frequency. R.B.

N71-11112# Joint Publications Research Service, Washington, D.C.

INITIAL MANIFESTATIONS OF NITROGEN NARCOSIS IN MAN

G. L. Zaltsman *In its* Hyperbaric Epilepsy and Narcosis 4 Nov. 1970 p 26–35 refs (See N71-11110 02-04)
Avail: NTIS

External manifestations of the initial stages of nitrogen narcosis and neurophysiological investigations were conducted on a group of test subjects who breathed air at pressures of 2, 4, 6, 8, and 10 atmospheres. Analysis of the test results and also of data of other investigators shows that the narcotic effect of atmospheric nitrogen appears in man at pressures of 6 atmospheres or higher in the form of various disorders of normal behavioral reactions, thinking activity, and perception, progressing from light euphoria to loss of consciousness. Different initial narcotic shifts and disorders have a diffuse and descending character, affecting primarily the most complexly organized and philogenetically 'young' functional formations of the brain. The principle EEG changes are reduced to suppression of the alpha-rhythm, domination of the rapid activity, and subsequent appearance of hypersynchronous slow activity. It is assumed that the nonspecific thalamo- and reticulo-cortical systems are the substrate of the shifts which set in. Author

N71-11113# Joint Publications Research Service, Washington, D.C.

INITIAL MANIFESTATIONS OF HELIUM NARCOSIS IN MAN

G. L. Zaltsman *In its* Hyperbaric Epilepsy and Narcosis 4 Nov. 1970 p 36–43 refs (See N71-11110 02-04)
Avail: NTIS

The external manifestations of helium narcosis and neurophysiological investigations were conducted on a group of test subjects who breathed 10 to 14% helium-oxygen mixtures at pressures of 10, 12, 14, and 16 atmospheres. Analysis of the results, and also of the data of other investigators, reveals an initial narcotic effect of a helium environment at pressures of 13 to 16 atmospheres or higher. The initial narcotic symptom is specific helium tremor of the upper extremities and trunk, with accompanying initial signs of bradykinesia, amimia, and rigidity of the muscles. Qualitative disturbances of the complex forms of cortical activity were not evident in a study of higher nervous activity. There was a definite general sluggishness of motor and verbal reactions, some reduction of ability to do intellectual work, and deterioration of memory. The changes in the general tonus of the cortex are connected with a direct change in the activity of the nonspecific thalamo-cortical system. The EEG studies showed a suppresion of alpha activity and a general shift of the biopotentials in the direction of higher frequencies. Author

N71-11114# Joint Publications Research Service, Washington, D.C.

DYNAMICS OF MANIFESTATIONS OF HYPERBARIC NARCOSIS IN MAN DURING EXPOSURE TO CONSTANT PRESSURE

Z. S. Gusinskiy et al *In its* Hyperbaric Epilepsy and Narcosis 4 Nov. 1970 p 44–55 refs (See N71-11110 02-04)
Avail: NTIS

The dynamics of narcotic manifestations of nitrogen, argon, and helium in test subjects exposed to constant pressure for one hour was investigated. The studies show that the value of the partial gas pressure and the time of its effect weaken or intensify the narcotic effect. Constant pressures of an inert gas which cause initial narcotic effects improve the well-being of the test subjects and produce normalization of behavioral and EEG shifts. Constant inert gas pressures having a well-expressed narcotic effect lead to wavelike changes in EEG patterns. High inert gas pressures lead initially to improvement in the well-being of the subjects, with a later deterioration, and an increase of EEG shifts. Author

N71-11115# Joint Publications Research Service, Washington, D.C.

COMBINED EFFECT OF INERT GASES UNDER PRESSURE ON MAN

V. V. Smolin et al *In its* Hyperbaric Epilepsy and Narcosis 4 Nov. 1970 p 56–66 refs (See N71-11110 02-04)
Avail: NTIS

Ten investigations were conducted on four test subjects for the complex effect of nitrogen, argon, and helium used in the composition of three- and four-component respiratory mixtures at total pressures of 9, 16, and 17.5 atmospheres. The studies show an intensification of initial symptoms and narcosis during the simultaneous effect of 4 atmospheres of nitrogen and 3.5 atmospheres of argon on the organism. The simultaneous effect of 6 atmospheres of nitrogen and 12 atmospheres of helium produces no apparent intensification of narcosis. Author

N71-11116# Joint Publications Research Service, Washington, D.C.

GENERAL FEATURES OF EPILEPTIC AND NARCOTIC TYPES OF CENTRAL NERVOUS SYSTEM BREAKDOWN

G. L. Zaltsman *In its* Hyperbaric Epilepsy and Narcosis 4 Nov. 1970 p 67–75 refs (See N71-11110 02-04)
Avail: NTIS

The functional state of the central nervous system during development of epilepsy and narcosis in man and animals subjected to the effect of elevated pressures of oxygen and inert gases is discussed from the standpoint of evolutionary physiology. The two opposite processes of generalized pathological excitation of the central nervous system and generalized pathological inhibition are considered. The evolutionary approach assumes comparison of different types of regressive development of functional systems with each other and requires study of how the regularities of their progressive development are reflected in the disintegration of functions. R.B.

N71-11117# California Inst. of Tech., Pasadena. Kerckhoff Labs. of Biology.

EFFECT OF PROCAINE ON ASPHYXIAL RIGIDITY

Janett Trubatch and A. Van Harreveld Repr. from Exp. Neurol., v. 27, no. 1, Apr. 1970 p 76–89 refs
(Contract Nonr-220(34))
(AD-712212) Copyright. Avail: NTIS CSCL 6/15

Procaine 0.2-0.5% was applied to the motor nerve of the gastrocnemius-soleus muscle of cats showing either "secondary" or "late" tone after asphyxiation of the cord for appropriate periods of time. The drug tended to abolish the responses both to sinusoidal slow and fast 0.2-2 cycle/sec stretch of the muscle before the muscle action potentials elicited by a single shock to the sciatic nerve started to decline. Although secondary tone in contrast to the late tone is characterized by considerable gamma-efferent activity, both forms of asphyxial rigidity were similarly affected by procaine. It was, therefore, postulated that, in addition to the selecteive effect of procaine on the gamma-efferents, this local anesthetic also affects the transmission of high frequency impulse trains in the Ia fibers, which represent the input for the myotatic reflex underlying the response of the muscle to stretch. Evidence was obtained that in the concentrations and time of application used to affect the stretch responses procaine impedes the transmission of high frequency trains of impulses. Author (TAB)

N71-11118# Texas Technological Univ., Lubbock. Center of Biotechnology and Human Performance.

EFFECTS OF TEMPORAL AND QUANTITATIVE DIETARY VARIABLES ON VIGILANCE PERFORMANCE

Margaret E. Kassouny, Charles G. Halcomb, and Barry P. McFarland Jun. 1970 16 p refs Submitted for publication
(Contract DAAD05-69-C-0102; Proj. Themis)
(AD-711564) Avail: NTIS CSCL 6/5

The purpose of the study was to define the effects of temporal as well as quantitative dietary variables on the performance of a vigilance task by a select group of subjects. A major objective was to determine intervals of time between ingestion and performance, and of meal size, which resulted in optimal maintenance of performance. Author (TAB)

N71-11119# Texas Technological Univ., Lubbock. Center of Biotechnology and Human Performance.

MONITORING PERFORMANCE WITH A TIME-SHARED MEMORY TASK

Charles G. Halcomb, Barry P. McFarland, and Nathan R. Denny Jun. 1970 16 p refs Submitted for publication
(Contract DAAD05-69-C-0102; Proj. Themis)
(AD-711565) Avail: NTIS CSCL 5/10

Thirty subjects participated in an auditory vigilance task, time-shared with a memory task. The results were examined for change in memory performance when performed independently or time-shared with the vigilance task. The vigilance performance demonstrated the classical vigilance decrement. Theoretical implications are suggested. Author (TAB)

N71-11120# Dunlap and Associates, Inc., Santa Monica, Calif.

ADAPTIVE TECHNIQUES IN PSYCHOPHYSIOLOGICAL MEASUREMENT

Daniel J. Prosin Aug. 1970 22 p refs
(Contract Nonr-4986(00))
(AD-712124) Avail: NTIS CSCL 6/16

The document reports on five studies in which different adaptive technique mechanizations were undertaken to demonstrate the possible uses of such technique in psychophysiological research. Galvanic skin response, respiratory cycle phase and reaction time were the responses utilized to control, in each case, some aspect of the task or stimuli. In the first study, galvanic skin response (GSR) was to be used to control the difficulty of a tracking task; in the second, GSR was used to control the presence or absence of a noxious stimulus in a conditioning paradigm; the third used GSR to control the time of presentation of stimuli in measurement of reaction time (RT), while respiratory cycle phases were used to control the presentation of RT stimuli in the fourth. In the last study reported, reaction times were used to control the intensity of subsequent reaction time stimuli. Author (TAB)

N71-11121# Army Aeromedical Research Lab., Fort Rucker, Ala.

MEDICAL AND PHYSIOLOGIC EFFECTS OF EJECTION AND PARACHUTING, AN OVERVIEW

Stanley C. Knapp Aug. 1970 20 p refs
(AD-711928; USAARL-71-9) Avail: NTIS CSCL 6/7

Design requirements for ejection seats and personal survival equipment sometimes omit as a criterion - man's physiologic and psychologic limitations. Man's ability to come through the ejection and parachute descent sequences uninjured is influenced directly by the design of the equipment and his experience in the techniques of proper use. Many limiting physiologic factors must be considered. Response to multiple accelerations in multiple axes, wind blast, effects of temperature extremes, anthropomorphic problems, and neuromuscular response are among the factors discussed. Engineers will find a knowledge of human factors vital to the design of seat restraint systems, cushions, accessory packs, control placement, catapults, the parachute, and etc. This broad overview reviews significant literature on sport free fall, military static line, HALO, and ejection parachuting statistics. Modes of injury and morbidity during ejection and parachuting are detailed. Author (TAB)

N71-11122# Duke Univ., Durham, N.C. Medical Center.

BRAIN ADENOSINE TRIPHOSPHATE: DECREASED CONCENTRATION PRECEDES CONVULSIONS

Aaron P. Sanders, Richard S. Kramer, Barnes Woodhall, and William D. Currie Repr. from Science, v. 169, 10 Jul. 1970 p 206–208 refs
(Contracts N00014-67-A-0251-0002; PHS-GM-14226-03)
(AD-712242) Copyright. Avail: NTIS CSCL 6/1

The concentration of adenosine triphosphate in the brain decreased before the onset of generalized convulsions in unanesthetized rats subjected to acute hypoxia or treated with hydroxylamine or pentylenetetrazole Metrazol. As the convulsive episode continued, adenosine triphosphate decreased further. Stimulation of adenosine triphosphate production forestalled its disappearance from the brain and delayed the development of seizure activity. Author (TAB)

N71-11123# Indiana Univ., Indianapolis. Dept. of Biochemistry.

HYPOXIA AND PARA-AMINOPROPIOPHENE AS RADIOPROTECTIVE AGENTS Final Report

John F. Bonner, Jr. 25 May 1970 9 p refs
(Contract AT(11-1)-1223)
(COO-1223-15) Avail: NTIS

Reaction mechanisms involved in the radioprotective effects of hypoxia and p-aminopropiophenone (PAPP) were investigated in mice. High pressure oxygen was found to increase the sensitivity of mice to x-rays. Methemoglobin producing drugs, antioxidants, and sulfhydryl compounds did not increase the survival of mice exposed to five atmospheres of oxygen. High partial pressures of CO2 provide a measurable radioprotective effect in mice. N-hydroxy-p-aminopropiophenone appeared to be the metabolite of PAPP responsible for the production of methemoglobinemia in experimental animals. The metabolism of PAPP was found to be complex; seven compounds were identified and at least two remain to be identified in mouse urine. Benzhydrazide prevented the production of methemoglobin by PAPP both in vivo and in vitro, presumably by blocking the N-hydroxylating enzymatic pathway. Author (NSA)

N71-11124# Oak Ridge Associated Universities, Tenn. Medical Div.

THEORY OF QUANTITATIVE RADIATION-RESPONSE TIME-DATA

Per-Erik E. Bergner Oct. 1969 25 p refs
(ORAU-109) Avail: NTIS

Preliminary results are given of an attempt to interpret partly unique clinical data obtained from patients with chronic lymphocytic leukemia. The data consist of white cell counts and platelet counts recorded for 42 days following a single, whole-body, therapeutic dose of gamma radiation. A definition of response mechanism is given in terms of effect and repair functions, and the possibility of significant differences of practical value is shown by analyses. The influence of dose level on both the magnitude and the kinetics of the response mechanism is analyzed quantitatively, and the value of conceptual, as opposed to statistical, analysis of biomedical data is discussed. NSA

N71-11476# Joint Publications Research Service, Washington, D.C.

SPACE BIOLOGY AND MEDICINE, VOLUME 4, NO. 4, 1970

26 Oct. 1970 137 p refs Transl. into ENGLISH of the periodical 'Kosmicheskaya Biologiya i Meditsina' Moscow, Med. Publishing House, 1970 p 1-89
(JPRS-51641) Avail: NTIS

The articles presented pertain to human factors engineering, life support systems, biotechnology, physiological and radiation effects, and medical science. For individual titles, see N71-11477 through N71-11497.

N71-11477# Joint Publications Research Service, Washington, D.C.

ANALYSIS OF BLOOD PRESSURE CHANGES IN HEART CAVITIES AND LARGE VESSELS IN DOGS DURING ACCELERATIONS IN DIFFERENT DIRECTIONS

A. S. Barer et al *In its* Space Biol. and Med., Vol. 4, No. 4, 1970 26 Oct. 1970 p 1-8 refs (See N71-11476 02-04)
Avail: NTIS

Dogs were exposed to accelerations of 2, 4, 6 and 10 g in a pelvis-to-head direction (at an angle of 0 deg), 4, 6, 10 and 12 g in a back-to-chest direction (at an angle of 90 deg), and 4, 6 and 10 g in a head-to-pelvis direction (at an angle of 180 deg). Miniature sensors were implanted in the right auricle and ventricle, the pulmonary artery, the thoracic and abdominal aortas for measuring blood pressure. The ECG, pneumogram and rectal pressure were also registered. During transverse accelerations the systolic and diastolic pressures increased in all the tested organs; this seems to be caused by increased resistance in systemic and pulmonary circulation. Author

N71-11480# Joint Publications Research Service, Washington, D.C.

COMPARATIVE EXPERIMENTAL STUDY OF THE CONTINUOUS AND INTERMITTENT EFFECT OF CARBON TETRACHLORIDE ON THE MICROSTRUCTURE OF ANIMAL ORGANS

G. P. Tikhonov et al *In its* Space Biol. and Med., Vol. 4, No. 4, 1970 26 Oct. 1970 p 27-33 refs (See N71-11476 02-04)
Avail: NTIS

The pattern and level of pathomorphological and histochemical processes that developed in the liver of test animals continuously and intermittently breathing carbon tetrachloride in a concentration of 0.5 mg/liter are discussed. Structural and metabolic disturbances developed in the liver three to four times sooner during a continuous exposure than during an intermittent exposure (six hours) of the same total duration. Author

N71-11481# Joint Publications Research Service, Washington, D.C.

EFFECT OF HYPOKINESIA ON THE PROTEIN COMPOSITION OF SKELETAL MUSCLES

M. S. Gayevskaya et al *In its* Space Biol. and Med., Vol. 4, No. 4, 1970 26 Oct. 1970 p 34-39 refs (See N71-11476 02-04)
Avail: NTIS

Experiments conducted on rats revealed that the animals did not develop hypokinesia immediately after their enclosure but only after extinction of the freedom reflex. During the period of muscular activity preceding hypokinesia the content of sarcoplasmic proteins decreased in the hind limb muscles whereas the quantity of myofibrillar proteins increased. The period of hypokinesia which followed considerably reduced the content of myofibrillar proteins in skeletal muscles but caused no changes in the concentration and composition of sarcoplasmic proteins. Author

N71-11482# Joint Publications Research Service, Washington, D.C.

MORPHOLOGICAL AND SOME HISTOCHEMICAL CHANGES IN THE LIVER AND KIDNEYS OF RATS DURING PROLONGED HYPOTHERMIA

V. I. Starostin et al *In its* Space Biol. and Med., Vol. 4, No. 4, 1970 26 Oct. 1970 p 40-45 refs (See N71-11476 02-04)
Avail: NTIS

A histologic and histochemical study was made of the liver and kidneys of rats exposed to 20 and 24 hour hypothermia. The animals killed during deep hypothermia exhibited the greatest changes. These included a decrease in phosphorylase activity and glycogen depletion (liver) and turbid swelling. These changes were accompanied by blood vessel congestion. Later most of the animals exhibited granulation tissue modules in the liver and some animals had structural damage of some kidney glomerules. After a long period of time most of the animals exhibited complete repair of liver and kidney structures. Author

N71-11483# Joint Publications Research Service, Washington, D.C.

CHOICE OF A CRITERION FOR EVALUATING RADIATION DAMAGE FOR DIFFERENT DOSE DEPTH DISTRIBUTIONS

Yu. G. Grigoryev et al *In its* Space Biol. and Med., Vol. 4, No. 4, 1970 26 Oct. 1970 p 46-54 refs (See N71-11476 02-04)
Avail: NTIS

The influence of a nonuniform dose depth distribution on the radiobiological effect was investigated on dogs. The tissue dose along the midline of the body was 20 percent of the surface dose. A comparison of the biological effect for similar mean tissue doses revealed significant differences in the clinical picture and severity of radiation sickness. Author

N71-11484# Joint Publications Research Service, Washington, D.C.

MEDICAL SUPPORT FOR PROLONGED SPACE FLIGHTS

T. N. Krupina et al *In its* Space Biol. and Med., Vol. 4, No. 4,

1970 26 Oct. 1970 p 55–60 refs (See N71-11476 02-04)
Avail: NTIS

Various problems involved in medical support of prolonged manned space missions are discussed. The authors stress the importance of experimental studies which may facilitate a reliable prediction and better understanding of the mechanisms of functional disturbances and diseases during prolonged flights. This is a necessary prerequisite for proper planning and timely rendering of in-flight medical assistance. It is also important to investigate the effect of various drugs on the human body, whose reactivity may change due to spaceflight factors, and to develop proper drugs and ascertain the correct dose. Some aspects of rendering specialized in-flight medical aid are described. It is emphasized that these problems can be solved only through the combined efforts of experts in different scientific fields. Author

N71-11485# Joint Publications Research Service, Washington, D.C.

HUMAN HEAT EXCHANGE STRUCTURE AND THE OVERHEATING MECHANISM AT HIGH AMBIENT TEMPERATURES

Ye. Ya. Shepelev *In its* Space Biol. and Med., Vol. 4, No. 4, 1970 26 Oct. 1970 p 61–66 refs (See N71-11476 02-04)
Avail: NTIS

Experimental data on structure of the human heat balance at high ambient temperatures under ground conditions and at reduced atmospheric pressure are presented. The collected data are used in discussing the most probable primary mechanism for increase in body temperature. It is shown that at high temperatures and with maintenance of a physiological humidity deficit in the surrounding air the increase in body temperature is related to a retention of the heat produced by the body and not to its entry from the surrounding air. The term external heat stress is redefined and made more precise. Author

N71-11486# Joint Publications Research Service, Washington, D.C.

SOME INDICES CHARACTERIZING THE HUMAN HEAT STRESS TOLERANCE LIMIT

R. F. Afanasyeva et al *In its* Space Biol. and Med., Vol. 4, No. 4, 1970 26 Oct. 1970 p 67–72 refs (See N71-11476 02-04)
Avail: NTIS

Some indices of the thermal state of human subjects exposed to heat stresses at rest and during physical exercises of different intensity are analyzed. The tolerance limit coincides with the following subjective sensations: marked deterioration of general feeling of well-being, nausea, impaired respiration, headache, fatigue, weakness, heart throbbing, and the following objective symptoms: irritability, blueness of skin and facial puffiness. An average body temperature of 38.5 to 38.8 C and a corresponding heat accumulation of 160-200 Cal can be used as an objective criterion for the human heat stress tolerance limit. Such characteristics of the human thermal state as rectal temperature, skin temperature, frequency of cardiac contractions and water losses are dependent on ambient temperature and humidity and the amount of work performed. Author

N71-11487# Joint Publications Research Service, Washington, D.C.

SOME CHARACTERISTICS OF EXTERNAL RESPIRATION AND ENERGY EXPENDITURES DURING ORTHOSTATIC TESTS BEFORE AND AFTER EIGHTEEN-HOUR IMMERSION

V. I. Sokolkov *In its* Space Biol. and Med., Vol. 4, No. 4, 1970 26 Oct. 1970 p 73–82 refs (See N71-11476 02-04)
Avail: NTIS

External respiration, metabolism and energy expenditures were studied during orthostatic tests before and after an 18-hour immersion experiment. Tilt tests at an angle of 90 deg were performed for 15 minutes. The subjects were classified into two groups on the basis of orthostatic tolerance. The first group included individuals with a high tolerance and the second included those with a reduced tolerance (regularly developing orthostatic collapses). During tilt tests the subjects in the second group exhibited statistically significant increases in pulmonary ventilation, oxygen consumption, release of carbon dioxide, and energy expenditures in comparison with subjects in the first group. Author

N71-11488# Joint Publications Research Service, Washington, D.C.

MODELING OF A NEURON NETWORK GENERATING STABLE RHYTHMIC IMPULSATION

B. G. Sushkov *In its* Space Biol. and Med., Vol. 4, No. 4, 1970 26 Oct. 1970 p 83–88 refs (See N71-11476 02-04)
Avail: NTIS

A system capable of generating a stable rhythmic impulsation is constructed from elements whose behavior is similar to that of nerve cells. The relationship between system performance and its parameters is discussed. This study may help in controlling similar neuron networks in living organisms, particularly in interpreting the genesis of vestibular nystagmus. Author

N71-11489# Joint Publications Research Service, Washington, D.C.

FUNCTIONAL STATE OF THE RIGHT HEART

N. P. Mironenko *In its* Space Biol. and Med., Vol. 4, No. 4, 1970 26 Oct. 1970 p 89–93 refs (See N71-11476 02-04)
Avail: NTIS

Experiments were made on 61 male test subjects in the age range from 20 to 40 years. Forty-seven were healthy, eight suffered from vascular dysfunction of the hypertension type and six were patients with hypertension disease in the first stage. The activity of the right heart was registered with an electrokymograph. The test subjects performed the Valsalva maneuver. It was found that during the provocative test the right ventricle with a normally short ejection period at rest is capable of increasing its contractive force to a greater extent than the ventricle with a shorter ejection period. Author

N71-11490# Joint Publications Research Service, Washington, D.C.

ELECTRONYSTAGMOGRAPHIC CHARACTERISTICS OF ADAPTATION PROCESSES IN THE VESTIBULAR SYSTEM

A. A. Shipov *In its* Space Biol. and Med., Vol. 4, No. 4, 1970 26 Oct. 1970 p 94–100 refs (See N71-11476 02-04)
Avail: NTIS

Experiments were performed on intact and unilaterally labyrinthectomized guinea pigs for determining extinction of number of nystagmic beats, duration and frequency of nystagmus during repeated exposures to angular accelerations of different intensity and similar duration. It was found that the extinction curves for each of the nystagmic reaction parameters can be approximated by exponential functions. The number of beats extinguished most rapidly (with the smallest rotation constant) whereas nystagmic frequency extinguished most slowly. The higher rates of nystagmic reaction corresponded to higher accelerations. Slower nystagmic extinction was observed in unilaterally labyrinthectomized guinea pigs than in intact animals. Author

N71-11491# Joint Publications Research Service, Washington, D.C.

SOME CLINICAL-BIOCHEMICAL INDICES OF HUMAN TOLERANCE TO IMPACT ACCELERATIONS

L. A. Rubashkina *In its* Space Biol. and Med., Vol. 4, No. 4, 1970 26 Oct. 1970 p 101–107 refs (See N71-11476 02-04)
Avail: NTIS

The degree of increase in aspartic aminotransferase activity with some indices indicating a high level of human tolerance to impact accelerations are compared. Accelerations imparted to the short and long axes of the body were investigated. With an increase from 25 to 35-40 g and the rate of transverse accelerations from 2,000 to 4,000 g/sec the appearance of limiting symptoms (shock, hematuria, proteinuria, bradycardia, ECG changes) was also accompanied by an increase in aspartic aminotransferase activity in the blood serum. The enzyme activity reached a maximum of 200-240 percent of the initial level during exposures to both transverse and longitudinal accelerations. Author

N71-11494# Joint Publications Research Service, Washington, D.C.

ROLE OF PROPRIOCEPTION IN SENSING BODY POSITION DURING FLIGHT IN A KEPLERIAN TRAJECTORY

I. F. Chekirda et al *In its* Space Biol. and Med. Vol. 4, No. 4, 1970 26 Oct. 1970 p 119–121 refs (See N71-11476 02-04)
Avail: NTIS

An investigation of the peculiarities in perception of the relative position of arm segments during reproduction of a stipulated joint angle under weightlessness conditions and accelerations is discussed. The tests showed that transition to a greater sensation of weight leads to overestimate of the angle of extension. Transition to a lesser sensation of weight or to weightlessness results in underestimation of the reproduced angle. Author

N71-11495# Joint Publications Research Service, Washington, D.C.

STUDY OF DRUG STABILITY UNDER UNUSUAL ENVIRONMENTAL CONDITIONS

I. P. Neumyvakin et al *In its* Space Biol. and Med., Vol. 4, No. 4, 1970 26 Oct. 1970 p 122–123 (See N71-11476 02-04)
Avail: NTIS

In some cases drugs can be exposed to a combination of such factors as increased temperature and humidity, a modified atmosphere, increased oxygen content, radiation, vacuum, vibration, and accelerations. A study of the tolerance to these factors for tablets of amobarbital sodium, caffeine, madribon, codeine phosphate with soda, and etaperazine is discussed. The drugs were arranged in trays and then exposed to different agents: increased temperature (+50 deg), high relative humidity (98 percent), vacuum (.0001 mm), radiation (30,000 rad), modified atmosphere, increased oxygen content (97 percent), vibration, and accelerations. The exposure levels were exaggerated in comparison with those expected so as to ensure preservation of the qualities of the investigated drugs. The trays were withdrawn for inspection at different stages in the research as the number of influencing factors was increased. Author

N71-11496# Joint Publications Research Service, Washington, D.C.

EFFECT OF A RATION WITH UNICELLULAR ALGAE ON THE CONDITION OF INTERNAL ORGANS IN RATS

A. V. Novokova et al *In its* Space Biol. and Med., Vol. 4, No. 4, 1970 26 Oct. 1970 p 124–126 refs (See N71-11476 02-04)
Avail: NTIS

The quality of the food components of the biomass of algae, particularly protein, are discussed. The effect of a ration with algae on the condition of the internal organs of animals after protein starvation is reported. The experiment demonstrated that the protein of a unicellular algae favored the recovery of the animals from a state of protein starvation almost the same as a casein diet. In contrast, in animals receiving soya protein the restoration of the internal organ structure and metabolism after protein starvation transpired far more slowly. The data confirm that the proteins of unicellular algae have a high biological value exceeding the value of soya protein. Author

N71-11497# Joint Publications Research Service, Washington, D.C.

EFFECT OF CHRONIC GAMMA IRRADIATION ON CELL DIVISION PROCESSES AND THE CHROMOSOMAL APPARATUS IN THE BONE MARROW OF DOGS

T. P. Tsessarskaya et al *In its* Space Biol. and Med., Vol. 4, No. 4, 1970 26 Oct. 1970 p 127–129 refs (See N71-11476 02-04)
Avail: NTIS

An experiment with the chronic irradiation of dogs is described. Cytogenetic data and the results of a study of different indices for the physiological regeneration of bone marrow in dogs exposed for a year to chronic irradiation and against this background, to single irradiations simulating solar flares are reported. Exposure to Co60 gamma rays was by means of special apparatus for 22 hours a day. Thermoluminescent dosimeters were attached to the collar of each animal for determining the dose. Bone marrow punctates were used in the investigation. Proliferative activity (total mitotic index and the mitotic indices for the principal bone marrow components); relative frequency of individual mitosis phases; intensity of DNA synthesis by bone marrow cells (autoradiography with thymidine H3 in experiments in vitro); frequency and nature of chromosomal aberrations visible in the anaphase and metaphse of mitosis are discussed. Author

N71-11711*# National Aeronautics and Space Administration, Washington, D.C.

THE INTERACTION OF LIVING SYSTEMS WITH THE SPACE ENVIRONMENT

Joseph F. Saunders *In its* Space Process. and Manufacturing 21 Oct. 1969 p 195–215 (See N71-11701 02-15)
Avail: NTIS CSCL 06C

Thirteen experiments flown in Biosatellite 2 were concerned with the role of gravity in living systems. Six experiments sought to determine the effects of weightlessness alone. Seven investigated the combined effects of radiation and weightlessness. It was found that weightlessness altered the orientation as well as the growth of plants. Bacteria, insects and plants exposed to gamma radiation while weightless confirmed that neutralization of gravity does change the effects of radiation on the cellular elements that control heredity. The primate in Biosatellite 3 showed physiologic deterioration attributed mainly to weightlessness. Author

N71-11713*# Martin Marietta Corp., Denver, Colo.

INDUSTRIAL MICROBIOLOGICAL APPLICATIONS IN ZERO GRAVITY: A VACCINE SATELLITE PROGRAM (VACSAT)

Russell T. Jordan *In* NASA Marshall Space Flight Center Space Process. and Manufacturing 21 Oct. 1969 p 238–251 refs (See N71-11701 02-15)
Avail: NTIS CSCL 06M

Discussed are some potential applications for manufacturing pharmaceuticals in an orbital workshop and presents a preliminary design for a zero G Fermenter with a proposed method for the unprecedented utilization of weightlessness in industrial fermentation. Author

N71-11801# Advisory Group for Aerospace Research and Development, Paris (France).

MEDICO-LEGAL ASPECTS OF AVIATION. RECENT ADVANCES IN AEROSPACE MEDICINE: LIFE SUPPORT AND PHYSIOLOGY

Sep. 1970 328 p refs Presented at 28th Aerospace Med. Panel Meeting, Florence, 21–24 Oct. 1969
(AGARD-CP-61-70) Avail: NTIS

The topics discussed pertain to the medico-legal aspects of aviation, clinical aviation medicine, aerospace medicine, and space medicine. For individual titles, see N71-11802 through N71-11830.

N71-11802# Army Board for Aviation Accident Research, Fort Rucker, Ala.

OPERATIONAL CHARACTERISTICS AND PILOT

EXPERIENCE IN ALCOHOL-CAUSED US GENERAL AVIATION ACCIDENTS
William H. Berner *In* AGARD Med.-Legal Aspects of Aviation Sep. 1970 6 p refs (See N71-11801 02-04)
Avail: NTIS

Examination of certain variables in aircraft accidents over a three year period involving aviators impaired by ingestion of alcohol revealed that there was very little difference between these accidents and US Civil General Aviation accidents as a whole with respect to pilot age, experience and Federal certification. The likelihood of alcohol playing a part in the accident cause is far greater for pleasure flying than for any other type. The low incidence of involvement in instructional flying, agricultural aerial application and air taxi operations indicates that a greater degree of professionalism and responsibility are exercised when the flight is for financial gain rather than for personal enjoyment. The very high incidence of operator errors such as stalls, spins, wire strikes, tree strikes, undershoots, etc., testifies to the degradation of pilot skill, coordination and perception caused by alcohol. The large number of cases of buzzing, acrobatics, and lack of respect for adverse weather indicates the effects of alcohol on critical judgment, caution, and mature behavior. This study has shown that prevention efforts to educate the aviator population in the dangers of alcohol and flying must be directed to all pilots, regardless of age or experience.
Author

N71-11803# Canadian Armed Forces Inst. of Environmental Medicine, Toronto (Ontario).
THE VALUE OF POST-MORTEM LACTATE ANALYSES IN AIRCRAFT ACCIDENT INVESTIGATION
W. R. Franks and I. H. Anderson *In* AGARD Med.-Legal Aspects of Aviation Sep. 1970 9 p refs (See N71-11801 02-04)
Avail: NTIS

Post-mortem lactic acid concentrations are used to determine the possible adrenergetic response to a dangerous flight situation; tissue lactate profiles are obtained by an increase in the ratio of kidney to liver lactate values. Comparison of lactate findings with the accident history indicates whether the pilot was aware of a severe problem more than 15 seconds prior to impact and thus establishes whether or not technical malfunction caused or precipitated the accident.
G.G.

N71-11804# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
TOXICOLOGY OF CARBON MONOXIDE IN ARTIFICIAL CABIN ATMOSPHERES
Anthony A. Thomas *In* AGARD Med.-Legal Aspects of Aviation Sep. 1970 4 p (See N71-11801 02-04)
(AMRL-TR-69-19) Avail: NTIS

The most likely problem contaminant in sealed cabins during long mission durations is carbon monoxide (CO). Sources for CO generation include gas-off from cabin construction materials, system and subsystem malfunctions, and the metabolic activity of the crew. Recent continuous exposure studies in 5 psia pure oxygen and mixed gas atmospheres with subhuman primates performing continuous and discrete avoidance tests on audio and visual cues during exposure to 55, 110, 220, and 440 mg of CO per cubic meter have indicated an unexpectedly high tolerance and perhaps the presence of some adaptive mechanisms. 125 ppm of CO had no demonstrable effect on higher mental integrating and coordinated neuromuscular function in human volunteer subjects for three-hour single exposure periods. There were no demonstrable physiological changes or clinical abnormalities.
Author

N71-11805# Royal Air Force Inst. of Pathology and Tropical Medicine, Aylesbury (England).
MEDICO-LEGAL RESPONSIBILITIES OF THE AVIATION PATHOLOGIST
J. K. Mason *In* AGARD Med.-Legal Aspects of Aviation Sep. 1970 9 p refs (See N71-11801 02-04)
Avail: NTIS

Attention is focused on the dual responsibilities of the pathologist investigating a fatal aircraft accident - to the Board of Inquiry and to the local jurisdiction. The responsibilities to the Board of Inquiry mainly involve attempts to establish the cause of the accident and the sequence of events. Less well appreciated are the strictly medico-legal duties of the pathologist. In addition to establishing who died, where, and by what means, the pathologist must be prepared to answer questions relating to factors such as aircraft control at the time of the accident, whether natural disease played any part in the death, whether there was negligence on the part of either the pilot or the manufacturers, and, finally, whether there was any evidence as to survivorship when close relatives were killed in the same accident.
Author

N71-11806# Belgian Air Force, Brussels.
MEDICAL SECRET AND APTITUDE OF FLYING [SECRET MEDICAL ET APTITUDE AU VOL]
E. Evrard *In* AGARD Med.-Legal Aspects of Aviation Sep. 1970 4 p In FRENCH (See N71-11801 02-04)
Avail: NTIS

Because medical facts between a private physician and his patient are privileged information, medical authorities of the military have grave difficulties in acquiring medical information to assess the aptitude of service pilots in the Belgian Air Force. An intern recommends changes and suggests that secret information be given military doctors upon request from military authorities. The information request would be precise requiring only that information necessary to evaluate the quality of the patient as pilot.
Transl. by E.H.W.

N71-11807# Centro di Studi e Richerche di Medicina Aeronautica e Spaziale, Rome (Italy).
REPEATED DECELERATIONS OF MODERATE INTENSITY AND THEIR HISTOPATHOLOGICAL AND BIOCHEMICAL EFFECTS
Gualtiero Paolucci *In* AGARD Med.-Legal Aspects of Aviation Sep. 1970 12 p refs (See N71-11801 02-04)
Avail: NTIS

Studies on deceleration show that: (1) injuries' gravity is a function of G intensity; (2) longitudinal positions are the most harmful; (3) tissue damage happens not only in organs placed along deceleration axes, but even out of their range; and (4) liver is the organ most frequently damaged. By two different experimental modalities, it was noted that single but abrupt decelerations over 300 G produce serious and acute organic damages and high serum enzyme activity, while repeated but medium decelerations don't produce acute organic damage and enzyme activity increase, but fibrosis and cellular reaction in liver, fibrosis in spleen and hypetrophy in suprarenal cortex, corresponding with a rise of gamma globulins, a trend to blood hypercoagulation, and a positivity of precipitin reactions.
Author

N71-11809# Italian Air Force Medical Service of the 2d Air Region, Rome.
A STATISTICAL STUDY OF ACCIDENTIAL TRAUMATISMS IN THE ITALIAN AIR FORCE
Aristide Scano and Roberto Santini *In* AGARD Med.-Legal Aspects of Aviation Sep. 1970 5 p (See N71-11801 02-04)
Avail: NTIS

On the basis of medical reports of all injuries through accidents suffered by military personnel, a statistical survey on type and localization of injuries and their causes, and possible connections with injured's position in the Italian Air Force, rank, age, time when the accident occurred etc., is made. The survey covers a period of 25 months and, on the basis of a statistically sound number of military personnel, shows an average percentage of injuries suffered within one month of about 0.3% of the personnel under consideration. Author

N71-11810# Advisory Group for Aerospace Research and Development, Paris (France).

DIFFICULTIES OF CIRCUMSCRIBING THE DANGER ZONES FOR THE OTHER PERSONNEL OF AERIAL RADAR [DIFFICULTES A CIRCONSCRIRE LES ZONES DANGEREUSES POUR LE PERSONNEL AUTOUR DES AERIENS RADAR]

L. Miro, G. Deltour, A. Pfister, and R. Kaiser *In* AGARD Med.-Legal Aspects of Aviation Sep. 1970 4 p In FRENCH (See N71-11801 02-04)

Avail: NTIS

Pathological manifestations due to hyperfrequency waves are very rare in the Western world. By contrast, it is of sufficient importance in Russia to justify the existence of a genuine professional disorder from which the different syndromes are described. This verification has brought about changes in preventive measures. These changes along with difficulties in applying security limits in current practice are discussed. An idea for simplifying the existing norms is also given. Transl. by E.H.W.

N71-11811# Royal Naval Air Medical School, Hillhead (England).

SPINAL INJURY RESULTING FROM EJECTION FROM ROYAL NAVAL AIRCRAFT, 1960 – 1968

F. St. C. Golden *In* AGARD Med.-Legal Aspects of Aviation Sep. 1970 9 p refs (See N71-11801 02-04)

Avail: NTIS

A survey of ejections from aircraft covering the period 1st January 1960 to 31st December 1968 has been carried out. There were 104 successful ejections, 42 of the ejectees were discovered subsequently to have fractures of one or more vertebrae. This represents an incidence of 40.4% which compares unfavorably with the published injury rate of the majority of users of Martin Baker seats who have an incidence of approximately 20%. The overall figures show a marked increase in spinal injury since 1966. Examined are the possible causes for this high incidence. One of the major contributing causes found was an increase in the included angle produced by a new method of parachute packing. The level at which the majority of fractures were found also differed from that described in previously published reports and this was found to be mainly a result of a large lumbar support cushion used in one aircraft type. Author

N71-11812# Flugmedizinisches Institut der Luftwaffe, Fuerstenfeldbruck (West Germany).

THE INCIDENCE OF BAROTRAUMA IN RELATION TO SINUS X-RAY AND NASAL PATHOLOGY

G. Froehlich *In* AGARD Med.-Legal Aspects of Aviation Sep. 1970 3 p (See N71-11801 02-04)

Avail: NTIS

One day after clinical examination and X-ray of sinuses, 476 healthy cadets were submitted to a low pressure chamber ride from 25000 ft to sea level with a rate of decend of 4000 ft/min. 16% of the cadets were found to have radiographic evidence of maxillary or frontal sinus disease, 32% had nasal pathology mostly some forms of rhinitis. During descent 56 (12%) of the total had a barotitis, only 13 (3%) of the subjects had had a significantly higher percentage of all forms of rhinitis, X-ray pathology in combination with nasal pathology or mucosal thickening of sinuses. There was no higher incidence of polypi or cysts, sinus opacity without nasal pathology, marked septal deviations or other nasal obstructions. In subjects having a barosinusitis there was a higher incidence of sinus opacity, all forms of rhinitis and X-ray pathology in combination with nasal pathology. No significant difference was found in sinus mucosal thickening, polypi or cysts, marked septal deviations and other nasal obstructions. The significance of these results in terms of medical standards and qualification for flying duties is being discussed. Author

N71-11813# Naval Medical Research Inst., Bethesda, Md.

EFFECT OF SIMULATED ALTITUDE ON EXPERIMENTAL INFECTIONS

Francis B. Gordon and James D. Gillmore *In* AGARD Med.-Legal Aspects of Aviation Sep. 1970 14 p refs (See N71-11801 02-04)

(NASA Order A-3061A)

Avail: NTIS CSCL 06S

The effect of abnormal atmospheric pressures and O2 tensions on experimental infections in the mouse were examined in an attempt to detect altered reactions between host and microorganism, and to identify potential problems relating to human infection in space vehicles or in undersea shelters. Mice infected by aerosols of influenza virus had a more severe pneumonia and sustained greater mortalities when exposed to increased O2 tensions in comparison to controls kept in ambient air. In confirmation of earlier reports, the hypoxia of a simulated altitude of 18,000 ft had the opposite effect – – the severity of the influenzal infection was reduced. When another pneumonia-producing agent (Chlamydia trachomatis, mouse pneumonitis strain) was used, hyperoxia exerted a protective effect and hypoxia enhanced the infection. The same was true when a similar agent (C. psittaci, psittacosis strain) was employed to induce a generalized infection. Mortality rates from both pneumonia-producing agents were increased when the mice were exposed to 100% O2 at 3.2 psia. Increased O2 tension had no apparent effect on Coxsackie B virus infection in adult mice, but hypoxia greatly increased the severity of the disease. Some of the described modifications of the disease process are correlated directly with changes in the amount of disease agent demonstrable in the tissues, but in others the mechanism of the observed alteration is obscure. Because of different effects of the same abnormal environment on different model infections it is probable that multiple factors are responsible for the observed changes. Author

N71-11815# Institut de Medecine Legale de l'Aviation Militaire, Rome (Italy).

PSYCHIATRIC SYNDROMES FOUND IN MILITARY PILOT TRAINEES: CLINICAL ASPECTS AND MEDICO-LEGAL [SYNDROMES PSYCHIQUES CHEZ LES ELEVES PILOTES MILITAIRES: ASPECTS CLINIQUES ET MEDICO-LEGAUX]

Luigi Longo *In* AGARD Med.-Legal Aspects of Aviation Sep. 1970 9 p In FRENCH; ENGLISH summary (See N71-11801 02-04)

Avail: NTIS

The results of a statistical study on psychiatric syndromes, found in trainees of the Flight School of the Italian Air Force in 1961-1966 are reported. The study surveys these results, in respect to level attained by the trainees, and to technical and cooperative characteristics of the School. The Author discusses also a nosographic table of different syndromes, after the better known trends of psychopathologic nomenclature (neurasthenic reactions: 46%; neurotic syndromes: 21%; neurovegetative disorder: 18%; after emotion psychogenic reactions: 12%, dysthimic psychosis: 3%). In conclusion, medico-legal aspects are analyzed, and considerations are discussed on prognosis and possible recovery of these subjects. Author

N71-11816# Flugmedizinisches Institut der Luftwaffe, Fuerstenfeldbruck (West Germany).

STRESS ON THE PILOT'S SPINE AND ITS PROGNOSTIC APPRAISAL

J. B. Boeger *In* AGARD Med.-Legal Aspects of Aviation Sep. 1970 8 p refs (See N71-11801 02-04)

Avail: NTIS

It is demonstrated that apparently healthy young men may have - more frequently than generally known - alterations of the spine which may reduce spinal tolerance to mechanical stress caused by military flying duty. Therefore it is necessary to include a prognostic assessment of the spine in the medical selection. The methods for spinal examination employed at the Institute of Aviation Medicine of the German Air Force are described; type and frequency of the most important findings and the criteria of judgment are outlined. Follow-up checks offering vast statistical material are to supplement the current investigations. Because approximately 5% of young men formerly judged totally fit for military service have to be withdrawn from pilot training later on, careful orthopedically-oriented prognostic assessment, generally including X-ray control, is mandatory. Author

N71-11817# Flugmedizinisches Institut der Luftwaffe, Fuerstenfeldbruck (West Germany).

DOES A CHRONIC GLAUCOMA NECESSITATE RELIEF FROM FLYING STATUS?

Dietrich Kuerschner *In* AGARD Med.-Legal Aspects of Aviation Sep. 1970 6 p refs (See N71-11801 02-04)
Avail: NTIS

From 1959 to 1969, 30,561 examinations for aircrew selection and survey have been conducted. 6,100 examinees were aged above 40. In seven cases glaucoma was detected. Glaucoma, therefore, does not constitute a problem as to its frequency but is of interest to the flight surgeon as far as the individual aviator is concerned. Whether a pilot with glaucoma should remain on flying status depends on his visual performance, the variety of glaucoma present (tonometric open-angle glaucoma), and on the practicability of short-interval follow-up checks. A glaucoma calling for treatment will exclude flying activities in any case. Finally certain legal aspects must be observed. Author

N71-11818# Italian Air Force Psycho-Physiological Institute, Naples.

VALIDITY OF SOME CARDIO-RESPIRATORY FUNCTIONAL TESTS (MAXIMUM VOLUNTARY EXERCISE, TILTING TABLE, HYPOXIA CORRESPONDING TO 5500 METRES ALTITUDE) ADMINISTERD DURING 9 YEARS IN THE IAF PSYCHO-PHYSIOLOGICAL INSTITUTE AT NAPLES, FOR MILITARY PILOTS SELECTION

Cesare Vacca and Alfonso Aurucci *In* AGARD Med.-Legal Aspects of Aviation Se. 1970 5 p refs (See N71-11801 02-04)
Avail: NTIS

In 9 years from 1960 to 1968 the Psycho-Physiological Institute of Naples has submitted at medical examination 7245 candidates to become pilot officer cadets in regular service. Subjects eliminated at the functional cardio-respiratory tests were only 0.70% against a total media of 62.30% for all the other medical examinations and tests. The cardio-respiratory tests were: (1) a maximum voluntary exercise performed with a bicycle-ergometer and an increasing load to the exhaustion of the subject; (2) a tilting table lasting 5 minutes at + or − 65 deg respectively. Blood pressure, pulmonary ventilation, heart frequency, and EKG record are controlled in each position; and (3) hypoxia, in which the subject breathes O2 in N2 at 9% for 15 minutes, measuring the same physiological parameters as in the tilting table test. Author

N71-11821# National Aeronautics and Space Administration, Washington, D.C.

BIOASTRONAUTIC ASPECTS OF APOLLO BIOMEDICAL OPERATIONS

Walton L. Jones *In* AGARD Med.-Legal Aspects of Aviation Sep. 1970 10 p (See N71-11801 02-04)
Avail: NTIS CSCL 06S

The absence of solar flare eliminated the radiation problem for Apollo, but for prolonged manned spaceflight the problem has not been solved. Crews have adapted generally to weightlessness and used it to advantage. Weight loss is still noted and it is only partly due to fluid loss. Sleep appears to be impaired and the relationship of work/rest cycles to task requirements needs further consideration. The preventive medicine program has been difficult to conduct but in the later flights it effectively reduced the pre-, in-, and postflight incidence of upper respiratory and gastrointestinal infection. Motion sickness has been noted in varying degrees but all astronauts have adapted well within a few days. A significant decrement in postflight work capacity has been noted to last 24 to 36 hours. The loss of red blood cell mass of Gemini was found only in Apollo 9, which was the only Apollo flight where the astronauts were exposed to pure oxygen at 5 psia for prolonged periods. The microbiological studies indicate an increase of intercrew transfer and growth of opportunist organisms, which could become a hazard in future spaceflight. Author

N71-11823# Ministry of Defence, London (England).

AIRSICKNESS DURING FLYING TRAINING

T. G. Dobie *In* AGARD Med.-Legal Aspects of Aviation Sep. 1970 4 p (See N71-11801 02-04)
Avail: NTIS

The purpose of this review is to examine the various aspects of airsickness which concern student aircrews. That is: the incidence of airsickness during flying training, possible methods of preselection to reduce the incidence, methods of prevention during training and treatment of the condition during this period based on data gathered over the last ten years. Author

N71-11824# Centro di Studi e Ricerche di Medicina Aeronautica e Spaziale, Rome (Italy).

ON THE PERCEPTION AND IDENTIFICATION OF IMAGES IN DIFFERENT ACCELERATIVE FIELDS, NOTE 2

G. Meineri and V. Sorano *In* AGARD Med.-Legal Aspects of Aviation Sep. 1970 10 p (See N71-11801 02-04)
Avail: NTIS

A complex apparatus for the presentation of luminous symbols (square, circle, triangle) against a background of complete darkness and lights was perfected. With this, the capacity of subjects, submitted to −1.4 and −2Gy in a centrifuge, to recognize symbols or perceive luminous stimuli was tested. Under acceleration there was a reduction of the field of vision and a diminution of the average number of symbols recognized according to a horizontal meridian. On the contrary, according to the vertical meridian and particularly in the case of the square, there was an increase in the number of symbols recognized. There resulted a shifting of the field of recognition of the symbol in a temporal direction. It is suggested that this depends on the mechanical shifting of the anteroposterior axis of the eye or an unconscious rotation of the eyeball. Author

N71-11825# Ulm Univ. (West Germany). Dept. of Neurology and Neurophysiology.

CHARACTERISTICS OF VOLUNTARY SACCADIC EYE-MOVEMENTS AND THEIR IMPORTANCE FOR PILOT PERFORMANCE

J. C. Aschoff *In* AGARD Med.-Legal Aspects of Aviation Sep. 1970 9 p refs (See N71-11801 02-04)
Avail: NTIS

Voluntary eye movements between fixed points (between instruments or instrument panel and horizon) are called saccades. Under normal conditions the following characteristics are observed: the speed of saccadic eye movements cannot be changed at will, contrary to skeleton muscle movements. The speed is determined by the amplitude of the saccade, influenced by the diurnal rhythm and slowed down significantly by prolonged wakefulness and by tranquilizers as well as by alcohol, which manifests the potential danger of Valium, librium or similar drugs. Stimulants cannot improve eye movement velocity or accuracy. For the layout of instrument panels it seems important that saccades towards the center are faster and more accurate than saccades towards the periphery, and that saccadic eye movements of more than 20 degrees amplitude are almost all biphasic with latencies up to 1/4 sec for corrective saccades. For emergency training one should be aware of men's capability to store eye tracking patterns and to perform this pattern (quick checking of several instruments) after some trials even after long intervals in reduced time. Author

N71-11826# Advisory Group for Aerospace Research and Development, Paris (France).

HISTOLOGICAL ASPECTS AND ULTRASTRUCTURE OF INTOXICATION IN RATS BY MEANS OF PURE OXYGEN AT LOW PRESSURE [ASPECTS HISTOLOGIQUES ET ULTRASTRUCTURAUX DE L'INTOXICATION DU RAT PAR DE L'OXYGENE PUR A FAIBLES PRESSIONS]

A. M. Pfister, S. Despres, C. Nogues, Y. Le Charpentier and J. J. Curgy *In its* Med.-Legal Aspects of Aviation Sep. 1970 29 p refs In FRENCH; ENGLISH summary (See N71-11801 02-04)

Avail: NTIS

Several batches of Wistar rats were exposed to rates of pure oxygen at pressures ranging from 600 to 450 mm Mercury, in a double low pressure chamber, for periods of 1 to 17 days. All the viscera were submitted to histological analyses. The modifications of the alveolar coating were studied by means of electronic microscopes. Blood modifications were investigated by means of hemograms and myelograms. The results of these studies are described and discussed. Author

N71-11827# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany). Inst. fuer Flugmedizin.

CIRCADIAN RYHTHMS OF PILOT'S PERFORMANCE IN A FLIGHT SIMULATOR AND EFFECTS OF TIME SHIFTS

K. E. Klein, H. Bruener, H. Holtmann, H. Rehme, J. Stolze et al *In* AGARD Med.-Legal Aspects of Aviation Sep. 1970 13 p refs (See N71-11801 02-04)

Avail: NTIS

If a standard instrument flight in a supersonic simulator was repeated in intervals of 2 hours the average performance of 12 pilots revealed a sinusoid circadian rhythm curve with the temporal position of peak and trough between 2 and 3 p.m. and 4 and 5 a.m., respectively. The amplitude of the diurnal oscillation came to an average of + or − 25 (12 - 49) % of the 24 hours total average as against + or − 12% found on average in the same subjects for the simple reaction time. After rapid transportation from Europe to the U.S. and back with a sojourn of 17 days (time shift: 8 h), the duration of resynchronization was about 5 days on average for both directions with a rate of phase adjustment of approximately 1.5 (1 - 2) h/day. The change in the performance level following transit, independent of the coincidence of old and new clock time, was unequal during the course of the day, but in general the level was significantly decreased (up to 40%) at day time and increased during the late night hours. A performance decrement seen for the 24 hours total average, in comparison to the preflight control, was significant only after the eastward (−8.5%) but not after the westward (−3.3%) flight. The reason for this difference is mainly seen in a greater fatigue due to an unfavorable flight schedule and the more severe sleep loss connected with eastward traveling. Author

N71-11828# Aerospace Medical Div. Aeromedical Research Lab. (6571st), Holloman AFB, N. Mex.

BIOCHEMICAL REGULATION OF THE SLEEP-WAKE AND TEMPERATURE CYCLES

G. Vernon Pegram and Thomas J. Crowley *In* AGARD Med.-Legal Aspects of Aviation Sep. 1970 10 p refs (See N71-11801 02-04)

Avail: NTIS

Both norepinephrine and serotonin occur naturally in the central nervous system and may act as central regulators of circadian temperature rhythms and sleep patterns. In this study specific changes in the sleep patterns and brain cortical temperature following depletion of norepinephrine and serotonin were studied in the primate. Monkeys treated with alpha-methylparatyrosine (AMPT), a specific norepinephrine depletor, showed a slight decrease in paradoxical (REM) sleep and were somewhat lethargic. Monkeys treated with parachloraphenenylalanine (PCPA), a specific serotonin depletor, showed a significant decrease in slow wave sleep (deep sleep) and a shift in the peak temperature rhythm. The serotonin depletion results suggest that artificial (biochemical) regulation of circadian rhythms may be possible. Author

N71-11829# Milan Univ. (Italy) Dept. of Human Physiology.

THE ORIBITING FROG OTOLITH EXPERIMENT

Torquato Gualtierotti *In* AGARD Med.-Legal Aspects of Aviation Sep. 1970 17 p refs (See N71-11801 02-04)

Avail: NTIS

The objective of the OFO (Orbiting Frog Otolith) experiment, a part of the vestibular program of the Office for Advanced Research and Technology of NASA, is to investigate directly the output of the vestibule during three days of orbital flight. The spike train data are recorded from the primary neurons of four vestibular statoreceptors of two paralyzed bullfrogs. A special biopackage has been designed, containing also a small centrifuge to provide 0.5 g of artificial gravity as a stimulus to the statoreceptors. The experiment will be launched by means of a Scout rocket in an especially built satellite capable of assuring 1,000 g of linear acceleration in all directions for the entire flight. Vestibular alteration due to weightlessness and possible adaptive trend will be studied. Author

N71-11830# Direction des Recherches et Moyens d'Essais, Paris (France).

UTILIZATION OF POTASSIUM SUPEROXIDE IN THE REGENERATION OF EXPIRED GAS [UTILISATION DU SUPEROXIDE DE POTASSIUM DANS LA REGENERATION DES GAZ EXPIRES]

P. Ganas *In* AGARD Med.-Legal Aspects of Aviation Sep. 1970 15 p refs In FRENCH (See N71-11801 02-04)

Avail: NTIS

The results of work in using KO2 as a means of regenerating expired gas in artificial atmospheres are given. Different phases of the work are given. The important phases include fabrication of KO2 in laboratories, fabrication of pellets in KO2 powder, physical and chemical analysis of the pellets, and a description of the operation. Simulators are used to determine the performance characteristics of the KO2. Transl. by E.H.W.

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N71-11175# Massachusetts Inst. of Tech., Cambridge Dept of Mathematics.

COMPUTER RECOGNITION OF PRISMATIC SOLIDS

Arnold Koons Griffith (Ph.D. Thesis) Aug. 1970 182 p refs (Contract N00014-20-A-0362-0002; Proj. Mac) (AD-712069; MAC-TR-73) Avail: NTIS CSCL 6/4

An investigation is made into the problem of constructing a model of the appearance to an optical input device of scenes consisting of plane-faced geometric solids. The goal is to study algorithms which find the real straight edges in the scenes, taking into account smooth variations in intensity over faces of the solids, blurring of edges and noise. A general mathematical analysis is made of optimal methods for identifying the edge lines in figures, given a raster of intensities covering the entire field of view. There is given in addition a suboptimal statistical decision procedure, based on the model, for the identification of a line within a narrow band on the field of view given an array of intensities from within the band. A computer program has been written and extensively tested which implements this procedure and extracts lines from real scenes. Other programs were written which judge the completeness of extracted sets of lines, and propose and test for additional lines which had escaped initial detection. The performance of these programs is discussed in relation to the theory derived from the model, and with regard to their use of global information in detecting and proposing lines. Author (TAB)

N71-11176# Human Resources Research Organization, Alexandria, Va.

HUMRRO RESEARCH IN TRAINING TECHNOLOGY

Jun. 1970 42 p refs Conf. held at Fort Monroe, Va. *Its* Profess. Paper No. 21-70

(Contract DAHC-19-70-C-0012)

(AD-712285) Avail: NTIS CSCL 5/9

The paper records four presentations on research and development in educational technology. The presentations describe research activities on individual training, with low apitude personnel and research in aviation training and aviation training devices. Author

N71-11177*# AiResearch Mfg. Co., Los Angeles, Calif.

ADVANCED EXTRAVEHICULAR SPACE (AES) SUIT Final Report

17 Aug. 1970 360 p

(Contract NAS9-7555)

(NASA-CR-108666; Rept-70-6613) Avail: NTIS CSCL 06K

A summary of achievements of the AEC program is presented along with conclusions and recommendations. Separate sections deal with: (1) program management and control; (2) system engineering; (3) system effectiveness; and (4) design and development. D.L.G.

N71-11178# Human Factors Research, Inc., Goleta, Calif.

HUMAN MONITORING PERFORMANCE Final Report, 1963 -1970

C. H. Baker, James F. O'Hanlon, Jr., William K. Earl, Donald N. Buckner, and Charles Abrams Aug. 1970 38 p refs

(Contract Nonr-4120(00))

(AD-711350; Rept-750-F) Avail: NTIS CSCL 6/16

The two general purposes of the research were: to increase knowledge of the relations of psychological and physiological variables to human monitoring performance, with the aim that such an increase would have practical implications for the many situations in Naval operations that require operators to remain alert over extended vigils; and to investigate display design variables and concepts that might enhance human monitoring performance. Author (TAB)

N71-11180# IIT Research Inst., Chicago, Ill.

DESIGN, DEVELOPMENT AND FABRICATION OF A PERSONNEL ARMOR LOAD PROFILE ANALYZER Final Report

F. Scribano, M. Burns, and E. R. Barron (Army Natick Labs., Mass.) Natick, Mass. Clothing and Org. Mater. Labs. Apr. 1970 121 p refs *Its* C and PLSEL No. 75

(Contract DAAG17-69-C-0008)

(AD-711876; USA-NLABS-TR-70-65-CE) Avail: NTIS CSCL 19/4

The purpose of the program was to design, develop, and fabricate an instrument which could locate and sense loads induced on the body of a person wearing protective armor, and to compare suspensions and suggest improvements which could be incorporated in current or future load-carrying systems. The development of a 'Personnel Armor Load Profile Analyzer' saw the attainment of a method of sensing loads, the integration and positioning of sensors in a suitable garment, a method of displaying information, and the correlation of output data to torso sensitivity. It was found that armor suspension systems could effectively be evaluated using this instrument. Static and dynamic load patterns were displayed and the shift in these patterns with articulation could be observed. The data obtained from the display could provide guidelines for improving suspension system design by determining whether a particular suspension was effective in distributing loads on the optimum load-bearing areas of the torso. The progressive electrical contact sensor approach provided a direct reading system with maximum reliability, ruggedness, and versatility. In addition, the system did not require special signal conditioning equipment. The variable inductance sensor approach produced an analcg sensor output converted to a digital display. Author (TAB)

N71-11181# National Bureau of Standards, Washington, D.C. Technical Analysis Div.

MAN, HIS JOB, AND THE ENVIRONMENT: A REVIEW AND ANNOTATED BIBLIOGRAPHY OF SELECTED RECENT RESEARCH ON HUMAN PERFORMANCE

William G. Mather, III, Boris V. Kit, Gail A. Bloch, and Martha F. Herman Oct. 1970 108 p refs Prepared for Post Office Dept. Human Factors Group

(NBS-Spec-Publ-319) Avail: SOD $1.00 Catalog No. C-13.10:319

Recent scientific literature was searched to review procedures currently being used to study human reactions to work and environmental stress. An ecological context is followed, considering task variables, environmental conditions, individual variations in subjects, and physiological, psycho-physical, psychological, and sociological responses. The different types of research reviewed included analyses of the job performance, simulations of real life situations, laboratory experiments with human and nonhuman subjects, and clinical studies. A methodological program is suggested for measuring the expenditure of effort in work situations. In addition to an extensive bibliography, detailed abstracts of 190 research reports are presented. Author

N71-11182# Royal Aircraft Establishment, Farnborough (England).

THE MAXIMUM DETECTION RANGE AND DISCOVERY OF LAND VEHICLES, FIRST SUPPLEMENT [DIE MAXIMALE AUFFASSREICHWEITE UND DIE AUFFINDBARKEIT VON LANDFAHRZEUGEN, 1 FORTSETZUNG]

H.-E. Hoffmann Jun. 1970 28 p refs Transl. into ENGLISH of German report DFVLR-0597- Supplement to DFL-0475

(RAE-Lib-Trans-1485; DFVLR-0597; DFL-0475) Avail: NTIS

A previous DFL-Bericht, No. 0475, dealt with the maximum detection range of and the search for land vehicles. In 1968 some of the tests involved were repeated with different observers, and in particular with a larger number of observers. The new tests, which were intended to explore how the maximum detection range depends on horizontal standard visibility, yielded to considerably smaller ranges than those of the previous year. The reason for these differences probably lies in the inexperience of the 1968 observers. They were unfamiliar with the changes in the appearance of an object with increasing distance. Where comparisons were possible, all the other investigations showed results similar to those found the year before. Author

N71-11183# National Bureau of Standards, Washington, D.C.

INVESTIGATION OF COLOR VISION OF DICHROMATS. SIGNIFICANCE OF THE INVESTIGATION OF VISION OF DICHROMATS AND THE METHODS OF INVESTIGATION

N. D. Nuberg et al 1969 175 p refs Transl. into ENGLISH from Russian report

(PB-190416T) Avail: NTIS CSCL 06P

The special characteristics of the vision of dichromats have always served and continue to serve as one of the most important criteria for assessing various theories of color vision. Therefore, in works on dichromatism various experimental facts are often stated from the point of view of a specific physiological theory. This sometimes leads to a mixture of results, not directly received from experiment, with conclusions based on specific hypothetical premises. In the beginning of our experimental research a number of facts were fixed. These facts are the following: (1) The additivity of colors is the same for normal trichromats as for dichromats. (2) Tri-dimensionality of color functions of trichromats and bi-dimensionality of dichromats. (3) The acceptance by dichromats of normal color equalities. Author (USGRDR)

N71-11184# Naval Training Device Center, Orlando, Fla. Human Factors Lab.

AN INTEGRATED APPROACH TO THE STUDY OF LEARNING, RETENTION, AND TRANSFER. A KEY ISSUE IN TRAINING DEVICE RESEARCH AND DEVELOPMENT

Arthur S. Blaiwes and James J. Regan Aug. 1970 36 p refs
(AD-712096; NAVTRADEVCEN-IH-178) Avail: NTIS CSCL 5/9

The report summarizes the approach, rationale, and some of the results of an effort being made to acquire information on learning, retention, and transfer which can be applied toward the solution of military training problems. A review of some relevant psychological theories and an analysis of some of the relevant research literature are included. Author (TAB)

N71-11185*# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.

ON FEATURE REDUCTION WITH APPLICATION TO ELECTROENCEPHALOGRAMS

Karkal Pulkeri Sheshagiri Prabhu Sep. 1970 159 p refs
(Grant NGL-22-007-143; Contract N00014-67-A-0298-0006)
(NASA-CR-111385; TR-615) Avail: NTIS CSCL 06B

The discrimination between two kinds of electroencephalogram (EEG) signals recorded from a human subject, spontaneous EEG and EEG driven by photic stimuli at the alpha frequency are reported. The feature reduction methods available are examined critically. A nonparametric feature reduction method based on a distance measure is developed, using the sampled values of the EEG. The computations involved in feature reduction also yield the best separating hyperplane at each stage. The error rate is less than five percent when the decisions are based on twenty periods of the alpha frequency. A random process model is developed for the two kinds of EEG signals based on the fact that the EEG driven at the alpha frequency has more phase coherence than the spontaneous EEG. The model is then employed for feature reduction and pattern classification. Author

N71-11186*# Texas Univ., Houston. Dental Science Inst.

STUDY TO DEFINE AND VERIFY THE PERSONAL ORAL HYGIENE REQUIREMENTS FOR EXTENDED MANNED SPACE FLIGHT Annual Report, 1 Aug. 1969 – 30 Aug. 1970

Lee R. Brown, Merrill G. Wheatcroft, and Sandra Allen 30 Aug. 1970 56 p refs
(Contract NAS9-8200)
(NASA-CR-108695; AR-2) Avail: NTIS CSCL 06I

Oral hygiene requirements for extended manned spacecraft flights were studied with small primates housed in a hyperbaric chamber simulating spacecraft environments. The primary objectives were to obtain a marmoset oral census before, during, and after isolation in the simulated environment, and to test sampling techniques that would be applicable to man. The results show: (1) Diarrhea and weight loss was a persistent problem associated with chamber isolation. (2) Significant increments of total anaerobes, bacteroides, neisseria, and streptococci occurred. (3) The greatest numerical change in the oral microflora of isolated animals was an increase in staphylococci. (4) The mouth may act as a reservoir for potentially pathogenic organisms. F.O.S.

N71-11187# Department of Labor, Washington, D.C. Manpower Administration.

PILOTS AND MECHANICS IN CIVIL AVIATION, 1967 – 1977. A STUDY OF MANPOWER REQUIREMENTS. PART 1: CURRENT SITUATION AND THE SHORT-RANGE OUTLOOK (MANPOWER ADMINISTRATION). PART 2: LONG-RANGE MANPOWER REQUIREMENTS (BUREAU OF LABOR STATISTICS)

1970 105 p refs
Avail: SOD $1.00

A study designed to evaluate current and future requirements and resources for pilots and mechanics in civil aviation in the United States over a ten-year period is presented. The first part of the study provides an analysis of current and short-range requirements and resources in each of the principle sectors of civil aviation, both in the airlines and general aviation categories. The second part presents projections of long-range manpower requirements, also by principle sectors of civil aviation, and the methods used to derive the projections. The data were derived from airlines, firms in general aviation, aviation schools, aircraft manufacturers, trade associations, trade unions, and government agencies. Author

N71-11188# Uniroyal, Inc., Wayne, N.J. Research Center.

RESEARCH AND DEVELOPMENT ON A PASSIVELY PRESSURIZED FLIGHT UNIFORM Final Report, Jul. 1966 – Oct. 1968

Robert A. Fowkes and Mark W. Olson Wright-Patterson AFB, Ohio AFML Dec. 1969 35 p
(Contract AF 33(615)-5261)
(AD-702537; AMRL-TR-69-56) Avail: NTIS CSCL 6/17

A high altitude protection suit of the partial pressure type was developed that utilizes 40 sealed cells, each containing a small air charge which expands according to Boyle's law when the atmospheric pressure is reduced. The independently acting, expandable, tubular cells are restrained within a stretch resistant but porous coverall in a manner to allow them to pressurize the body of the wearer. When the coverall is worn with pressure gloves, boots and a pressure helmet, it is possible to pressurize the entire body sufficiently for altitude exposure up to 100,000 feet for at least several minutes. The suit is fabricated of NOMEX material, with pleated cells of polyurethane, and an inner comfort liner. The experimental suits were evaluated through actual wear in altitude chambers and the results confirm the potential of this approach for providing aircrew protection. Further refinement is needed to obtain a design more suitable for use in the field and to assure balanced respiratory pressures. Author (USGRDR)

N71-11189* National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

BIOMEDICAL ELECTRODE ARRANGEMENT Patent

James A. Roman, inventor (to NASA) Issued 20 Oct. 1970 (Filed 24 Mar. 1967) 12 p Int. Cl. A61b5/04
(NASA-Case-XFR-10856; US-Patent-3,534,727;
US-Patent-Appl-SN-626376) Avail: US Patent Office CSCL 06B

An electromedical device is described for applying vectorcardiograph-type electrodes to a patient's body so that data may be gathered while the patient is physically active. The electrodes provide signals with a high signal-to-noise ratio. An elastic garment, tailored to tightly fit a selected naked portion of a human torso, supports a plurality of electrodes. The electrodes are flexible with an elastic layer of conductive cloth. The conductive layer of each electrode is electrically connected by a separate conductive wire to an output connector which may be connected to a standard vectorcardiogram recording device. J.M.

N71-11190* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

HELMET ASSEMBLY AND LATCH MEANS THEREFOR Patent

Robert L. Jones, inventor (to NASA) Issued 24 Mar. 1970 (Filed 3 Jan. 1968) 12 p Cl. 128-142.5; Int. Cl. A62b7/00; Intl. Cl. A42b3/00

(NASA-Case-XMS-04935; US-Patent-3,502,074;
US-Patent-Appl-SN-518487) Avail: US Patent Office CSCL 06K

A single unit construction, transparent-polycarbonate resin shell helmet assembly is described. The shell is shaped to allow complete freedom of normal head movement. An air distributing and shock absorbing pad secured in the rear of the shell cooperates with an air valve in the suit for supplying breathing, cooling, and defogging air. An automatic latch secures the shell to a pressurized flight suit with a push button release. Impact protection for severe impact is provided by a removable internal bump cap and an external pad. The communications are carried on a skull cap which can be worn with or without the shell and an extravehicular, snap-on visor assembly is provided to protect the wearer against glare and radiation. Various views of the shell helmet are included. J.M.

N71-11191# Joint Publications Research Service, Washington, D.C.
LIFE SUPPORT PROBLEMS IN SPACE
6 Nov. 1970 26 p refs Transl. into ENGLISH of eight Russian pamphlets
(JPRS-51736) Avail: NTIS

An artificial earth satellite for studying solar X-rays and ultraviolet radiation was developed based on the Cosmos series; it is permanently oriented toward the sun. The launching and landing dates, weight (kg), perigee, apogee, orbital period, orbital inclination, flight data, and cosmonauts of Vostoch and Voskod spacecraft are given. Various medical investigations on Soviet satellites are briefly mentioned, emphasizing the Cosmos 110 experiment. A state-of-the-art review is presented for bioengineering of life support systems. J.A.M.

N71-11192# Becton, Dickinson and Co., Raleigh, N.C. Research Center.
THE TYPES OF BIOLOGICAL INDICATORS USED IN MONITORING STERLIZATION PROCESSES
William S. Miller 23 Nov. 1970 12 p refs Presented at the Ann. Conv. of the Parenteral Drug Assoc., New York, 11-13 Nov. 1970
(TR-34) Avail: NTIS

Several types of biological indicators were reviewed. The preliminary work which preceded their selection and the bases on which a particular indicator was evaluated are given. Information is provided on the importance of preparation method in order to obtain consistent indicator performance. Studies of a number of factors influencing organism resistance indicate that method of preparation can result in resistance differences greater than those normally seen between common indicator species. The critical points for the valid use of biological indicators include correlation of resistance with that of the most resistant organism found on the materials before sterilization, certified and adequately controlled sterilization cycles, uniformity in indicator production and comprehensive sterility test programs for both indicators and products. Author

N71-11193* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ELECTRODE CONSTRUCTION Patent
Richard M. Westbrook and Joseph J. Zuccaro, inventors (to NASA) Issued 28 Apr. 1970 (Filed 16 Oct. 1967) 5 p Cl. 128-2.1; Int. Cl. A61b5/04
(NASA-Case-ARC-10043-1; US-Patent-3,508,541;
US-Patent-Appl-SN-676012) Avail: US Patent Office CSCL 06B

An electrode construction comprising a cap of insulating material attached to the helmet of the subject for detecting low level signals from the skin of living creatures is described. The electrode member is positioned adjacent a layer of permeable material such as compressed AgCl, which maintains its position by a rigid disc of fritted glass fixedly mounted in the cap. A resilient permeable material e.g. sponge is carried by the cap and engages the fritted glass disc. This device which has a low source impedance and is substantially free of motion artifacts, is particularly adapted for use in obtaining EEG and other data. The size of the helmet and liner, as well as the length of the electrodes may be adapted to fit the subject. E.M.C.

N71-11194* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SPACE SUIT PRESSURE STABILIZER Patent
Donald E. Barthlome, inventor (to NASA) Issued 20 Oct. 1970 (Filed 6 Sep. 1968) 9 p Cl. 2-2.1; Int. Cl. A62b17/00; Int. Cl. F16l55/04
(NASA-Case-XLA-05332; US-Patent-3,534,407;
US-Patent-Appl-SN-757861) Avail: US Patent Office CSCL 06K

A space suit having a compensator system designed to maintain the pressurizing gas inside the inflatable space suit at a constant pressure and volume is described. In operation the compensator receives the excess inflation volume forced out of the bent joint and returns this excess volume to the joint when the limb is again straightened without a corresponding change in suit pressure at the bent joint. This eliminates the necessity for constant volume joints in the space suit. Accordingly, the pressure stabilizer minimizes the energy required by an astronaut to bend his limbs during extravehicular activity and at other times. The pressure stabilizer in a backpack arrangement is connected to, and in fluid communication with the interior of the space suit. Detailed descriptions are included with drawings of the space suit. E.M.C.

N71-11195* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EQUIPOTENTIAL SPACE SUIT Patent
Donald E. Barthlome, inventor (to NASA) Issued 20 Oct. 1970 (Filed 24 Oct. 1968) 9 p Cl. 2-2.1; Int. Cl. B63c11/04
(NASA-Case-LAR-10007-1; US-Patent-3,534,406;
US-Patent-Appl-SN-770203) Avail: US Patent Office CSCL 06K

The equipotential space suit aims at utilizing simple spring type mechanical aids, termed joint assists, which minimize the energy requirements imposed upon the astronaut to bend his limbs while wearing the space suit. It also contains joints which possess reliable construction features permitting pressurization well within the region associated with a two gas system. The basic suit is assumed to be inflatable and has separable sections joined together; the joint assist mechanisms, disposed exterior of the suit at each movable joint, keep the bent joint in a state of near-neutral equilibrium. Consequently, the astronaut need only supply energy associated with inertia and friction. A detailed description and drawings are included. An additional mechanism for assisting in movement of the hip joint includes an inverted V-shaped housing with a pair of movable pistons, each under the influence of a coil spring. E.M.C.

N71-11196# Battelle-Northwest Richland, Wash. Pacific Northwest Lab.
USE OF SOLID STATE DETECTORS FOR ORGAN COUNTING
D. McConnon Jul. 1970 13 p refs
(Contract AT(45-1)-1830)
(BNWL-1178) Avail: NTIS

Results of in vivo measurement of a complex mixture of gamma emitters with conventional whole body or organ counting systems are often unsatisfactory because of the poor resolution of the counting system. The possibility of eliminating this problem by the use of a counting system employing a high resolution solid state detector prompted study of such a system to determine its suitability in measuring amounts of radionuclides in individual organs. The response of a dual crystal Ge(Li) detector to gamma emitters contained in various organ compartments of an anthropomorphic phantom was measured. The study indicated that even though its sensitivity is poor relative to that of conventional organ counting systems, use of a solid state system may yield useful supplemental information for assessment of internal depositions, provided the amount deposited in the organ is sufficiently large, and that the background and counting geometry are controlled. Author (NSA)

N71-11197# Argonne Cancer Research Hospital, Chicago, Ill.

HIGH RESOLUTION OF RECTILINEAR BRAIN SCANNING: IS IT WORTH THE EFFORT?

Alexander Gottschalk 23 Jan. 1970 16 p Presented at the 2d Ann. Meeting of the Nucl. Med. Seminar, Miami Beach, Fla., 19–23 Jan. 1970
(ACRH-1000-190; CONF-700110-2) Avail: NTIS

The brain scanner at Argonne Cancer Research Hospital, consisting of four detectors and high-resolution collimators, is briefly described and compared to the conventional three inch scanner and Anger camera. NSA

N71-11198 Naval Personnel and Training Research Lab., San Diego, Calif.

TASK ANALYSIS REDUCTION TECHNIQUE (TART) FOR THE QUANTIFICATION OF HUMAN PERFORMANCE

Robert H. Ellis Sep. 1970 37 p refs
(AD-711807; SRM-71-7) Avail: NTIS CSCL 5/9

A Task Analysis Reduction Technique (TART) for collecting human factors information was developed and applied to the anti-submarine warfare tactical data system. TART is a specific procedure for analyzing the man/machine interface which allows the researcher to analyze sequential properties of the man/machine interaction. The technique is based on an analysis of the interface at a task level and uses closed circuit television and video tape recording apparatus. A trial application was performed using four air detector/trackers who were presented a one-hour air scenario in the anti-submarine warfare tactical data system. The results section presents various breakdowns of the TART data and indicate that TART can provide valuable insight into man/machine design and training effectiveness decisions. Author (TAB)

N71-11199* Martin-Marietta Corp., Baltimore, Md.

EMERGENCY ESCAPE SYSTEM Patent

Wolfgang G. Offik, inventor (to NASA) Issued 26 Jul. 1966 (Filed 29 Oct. 1964) 6 p Cl. 182-191 Sponsored by NASA
(NASA-Case-XKS-02342; US-Patent-3,262,518;
US-Patent-Appl-SN-407603) Avail: US Patent Office CSCL 06G

An escape system for evacuating personnel from tall buildings where there is a possibility of explosions, such as launch towers, is described. A rescue cabin is guided through a domed roof into an underground shelter. The bottom of the cabin is conical and penetrates a bed of granular material, providing the deceleration. When the cabin is at rest the personnel depart and proceed through an underground tunnel. The shelter roof prevents liquid propellants from entering the shelter before the cabin crashes through it, and only a comparably small opening is made by the cabin. The roof is easily replaced to allow for training. N.E.N.

N71-11200# Mine Safety Appliances Co., Pittsburgh, Pa.

DEVELOPMENT AND FABRICATION OF A POLYCARBONATE EYESHIELD FOR THE US ARMY FLYER' S HELMET Final Report

Abraham L. Lastnik (Army Natick Labs., Mass.), Bruce T. Cleavly, and John B. Brown Natick, Mass. Natick Labs. Jun. 1970 29 p refs *Its* C and PLSEL No. 76
(Contract DA-19-129-AMC-332)
(AD-712313; USA-NLABS-TR-71-3-CE) Avail: NTIS CSCL 6/17

The need to provide U.S. Army aircrewmen with increased eye protection saw a production technique developed to make optically acceptable, shatter- and impact-resistant eyeshields from polycarbonate resin. It was found that production quantities of optically transparent polycarbonate lenses can be manufactured with a great deal of reliability by injection-molding processes. Injection-molding of polycarbonate lenses employs standard equipment and techniques. These, however, must be adjusted to account for the idiosyncrasies of the resin, e.g., hygroscopic and flow characteristics. In this fabrication project, the mold used was end-gated and highly polished. Of three available grades of resin, the material with the lowest molecular viscosity provided the best results. The development molds produced about 75,000 acceptable eyeshields which were made available to U.S. Army and Air Force airmen for immediate tactical use. The polycarbonate resin characteristics and molding techniques that influenced the design of the eyeshield, and the development of the fabrication technique are discussed. Also discussed are factors that governed the selection of material type, mold design, and quality assurance considerations. Author (TAB)

N71-11201# Washington Univ., Seattle. Dept. of Psychology.

COMBINATORIAL PROPERTIES OF PERSONAL PROBABILITIES

Scott Barclay and Lee Roy Beach 7 Sep. 1970 17 p refs
(Contract N00014-67-A-0103-0011)
(AD-712119; Rept-70-01-09) Avail: NTIS CSCL 5/10

An experiment in decision making examined the degree to which personal probabilities, subjective probabilities which need not have objective counterparts, conform to probability theory. Subjects gave subjective probability estimates from complex and elementary events. The degree of conformity to probability theory is evaluated by the degree to which probabilities for complex events could be predicted from the proper combination of the probabilities for elementary events. Author

N71-11202* North American Aviation, Inc., Los Angeles, Calif.

METHOD AND SYSTEM FOR RESPIRATION ANALYSIS Patent

Gordon W. Campbell and Robert K. Breeze, inventors (to NASA) Issued 21 Apr. 1970 (Filed 9 Feb. 1968) 6 p Cl. 73-23; Int. Cl. G01n7/02 Sponsored by NASA
(NASA-Case-XFR-08403; US-Patent-3,507,146;
US-Patent-Appl-SN-704420) Avail: US Patent Office CSCL 06B

A respiration analyzing method and apparatus are described for determining an individual's oxygen consumption in space environments. The apparatus consists of a mouthpiece connected with separate inlet and outlet lines, a breathing valve, and a flow meter on the inlet line. The volumes of inhaled and exhaled oxygen are determined by alternately sampling small amounts of inlet and outlet streams from the mouthpiece. The stream samples are directed to oxygen and carbon dioxide partial pressure sensors and a total gas pressure sensor. An explanation of the required calculations is included with diagrams of the apparatus. J.M.

N71-11203* Garrett Corp., Los Angeles, Calif.

PORTABLE ENVIRONMENTAL CONTROL SYSTEM Patent

William J. O'Reilly, Donald A. Myers, and Paul D. Peterson, inventors (to NASA) Issued 17 Mar. 1970 (Filed 16 Jan. 1969) 9 p Cl. 128-142.5; Int. Cl. A62b7/02; Int. Cl. A61m15/00; Int. Cl. F24f7/06 Sponsored by NASA
(NASA-Case-XMS-09632-1; US-Patent-3,500,827;
US-Patent-Appl-SN-791693) Avail: US Patent Office CSCL 06K

A portable environmental control system is described which is uniquely adapted for use by a crewman in extravehicular activity as well as within a spacecraft during a space flight mission. The system includes a breathable fluid circuit for pressurizing and supplying oxygen to a crewman's protective garment, and a liquid circuit for circulating and supplying a cooling liquid such as water to the protective garment. The breathable fluid and liquid circuits are heat exchange and pressure interrelated and circulation of both systems is mechanically induced by a single power system. As a result, volume and power requirements are greatly reduced and metabolic load capabilities are substantially increased. Descriptive drawings of the device are included. E.M.C.

N71-11204*# TRW, Inc., Cleveland, Ohio.

AIRCREW OXYGEN SYSTEM DEVELOPMENT CARBON DIOXIDE CONCENTRATOR SUBSYSTEM REPORT

R. G. Huebscher and A. D. Babinsky Jul. 1970 185 p refs
(Contract NAS2-4444)
(NASA-CR-73397; TRW-ER-7256-24) Avail: NTIS CSCL 06K

The results are presented of a program to develop a closed loop aircrew oxygen system which generates oxygen on-board the aircraft as required. A water electrolysis module is used as the oxygen generator, and the amount of oxygen required is decreased significantly through the use of a closed loop rebreather system. The rebreather loop functions to condition the exhaled gas such that it can be reused in the breathing cycle. The rebreather must remove exhaled carbon dioxide, nitrogen, water vapor, and heat. Removal of carbon dioxide is accomplished by an electrochemical carbon dioxide concentrating module. The module consists of cells in which two porous electrodes are separated by an asbestos capillary matrix containing an aqueous solution of an alkali metal carbonate. Cell plates adjacent to the electrodes provide passageways for distributing the gaseous reactants over the surface of the electrodes. Author

N71-11205# Dunlap and Associates, Inc., Santa Monica, Calif. Western Div.

A MANUAL FOR ADAPTIVE TECHNIQUES: DESIGN, MEASUREMENT, RESEARCH AND TRAINING, APPLICATIONS OF THE DUNLAP ADAPTIVE TECHNIQUE Final Report

Charles R. Kelley and Erica J. Kelly 15 Aug. 1970 133 p refs
(Contract Nonr-4986(00))
(AD-711985; NR-196-050) Avail: NTIS CSCL 5/9

Adaptation in human tasks and man-machine systems occurs when a response is employed to modify the task, problem or stimulus. The method of adaptation developed and employed in the Dunlap and Associates, Inc. laboratories uses adjustment of an adaptive variable to keep a performance measurement constant. The adaptive variable can then be used as a new index of performance. The nature, history and usefulness of the Dunlap type of adaptive task or system are discussed. Guidelines for applying the technique in continuous and discrete tasks are developed, including four primary adaptive equations, and applications are described for the four forms of adaptive logic represented by these equations. Research studies directly relevant to the Dunlap adaptive technique are abstracted, and 66 references are listed. Author (TAB)

N71-11206*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

APOLLO OPERATIONS HANDBOOK, EXTRAVEHICULAR MOBILITY UNIT. VOLUME 1: SYSTEM DESCRIPTION, CSD-A-789-(1), APOLLO 14

Jun. 1970 110 p refs Revised
(NASA-TM-X-66478; MSC-01372-1-Vol-1-Rev-4;
CSD-A-789-(1)-Vol-1-Rev-4) Avail: NTIS CSCL 06K

The extravehicular mobility unit is designed to protect the crewman in a low pressure environment and provide comfort, mobility, dexterity, and a specified unobstructed range of vision during pressurized and unpressurized modes of operation. There are two basic configurations which support an Apollo mission: an intravehicular configuration which affords pressure and fire protection, and an extravehicular configuration which provides pressure, fire, thermal, and micrometeoroid protection. Connectors permit both configurations to interface with spacecraft systems for pressurization, ventilation, communications, cooling, and waste management purposes. The EV configuration incorporates the portable life support system (PLSS) for pressurization, ventilation, communications, and temperature control when used for EV phases of the mission. Waste management systems are self-contained in both configurations. Author

N71-11207* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

RECOVERY OF POTABLE WATER FROM HUMAN WASTES IN BELOW-G CONDITIONS Patent

Dan C. Popma and Vernon G. Collins, inventors (to NASA) Issued 13 May 1969 (Filed 8 May 1967) 9 p Cl. 202-182; Int. Cl. C02c1/00, 3/00; Int. Cl. B01d3/00
(NASA-Case-XLA-03213; US-Patent-3,444,051;
US-Patent-Appl-SN-621715) Avail: US Patent Office CSCL 06K

A water reclamation system consisting of evaporator, condenser, and residue removal units is described. The system uses waste heat to obtain positive separation of clean vapors from the waste liquids. Solid waste salts are precipitated out of waste fluid by a combination of crystallization by cooling and filtration. The remaining waste fluid is recycled for further evaporation and separation from clean vapors. N.E.N.

N71-11478# Joint Publications Research Service, Washington, D.C.

ANALYSIS OF STABILITY OF EXTERNAL MASS EXCHANGE IN CLOSED LIFE SUPPORT SYSTEMS

V. M. Volynets et al *In its* Space Biol. and Med., Vol. 4, No. 4, 1970 26 Oct. 1970 p 9–16 refs (See N71-11476 02-04)
Avail: NTIS

A mathematical model for mass exchange in closed life support systems is presented. A method for solving systems of equations and an evaluation of mass exchange stability are described. Author

N71-11479# Joint Publications Research Service, Washington, D.C.

SANITARY AND CHEMICAL STUDIES OF SOME POLYMERS

S. M. Gorodinskiy et al *In its* Space Biol. and Med., Vol. 4, No. 4, 1970 26 Oct. 1970 p 17–26 refs (See N71-11476 02-04)
Avail: NTIS

A comparative evaluation of the sanitary and chemical properties of polymers is described. It takes into account such specific operating conditions as isolation of a chamber and its pressurization, high saturation of the chamber atmosphere by the material and low operating temperature. The sanitary and chemical studies of polymers were made in a vacuum, reduced oxygen pressure (0.2–0.4 atm), and also at atmospheric pressure. The temperature range studied was from room temperature to 200 F. More than 25 materials were studied, including those based on polyvinyl chloride, caprolactam, polycarbonate, polyurethanes, natural and synthetic fibers, rubbers, sealings, glass plastics and plexiglass. It is shown that the hygienic properties of polymers can be improved by vacuum processing, addition of stabilizers, heating, and washing with water. Author

N71-11492# Joint Publications Research Service, Washington, D.C.

SOME RESULTS OF OPERATION OF THE SELF-CONTAINED LIFE SUPPORT SYSTEM DURING FLIGHT OF THE 'SOYUZ 4' AND 'SOYUZ 5' SPACESHIPS

I. P. Abramov *In its* Space Biol. and Med., Vol. 4, No. 4, 1970 26 Oct. 1970 p 108–112 refs (See N71-11476 02-04)
Avail: NTIS

The characteristics and operation of self-contained life support systems used in Soyuz spacecraft are presented. The system is designed to operate for several hours and was operated for one hour in space during transfer of cosmonauts from one spacecraft to another. In the event of malfunction, a warning signal sounds and the backpack duplication system begins to operate. The system contains instrumentation for medical monitoring of the cosmonaut's condition and for checking the operation of the individual system assemblies. P.N.F.

N71-11493# Joint Publications Research Service, Washington, D.C.

METHOD FOR INVESTIGATING HUMAN METABOLISM IN A RARIFIED ATMOSPHERE BY GAS CHROMATOGRAPHY

V. I. Chadov et al *In its* Space Biol. and Med., Vol. 4, No. 4, 1970 26 Oct. 1970 p 113–118 refs (See N71-11476 02-04)
Avail: NTIS

A method for determining human metabolism in a rarefied atmosphere using a special apparatus for sampling the exhaled gas mixture with subsequent analysis by the gas chromatography method is described. The use of gas chromatography for these purposes makes it possible to increase accuracy and sharply reduce the time required for analyzing the gas mixture. Author

N71-11808# Institut de Medecine Legale de l'Aviation Militaire, Rome (Italy).

CHARACTERISTICS OF ACOUSTIC DAMAGE FOUND IN TECHNICAL MILITARY PERSONNEL [LE DOMMAGE ACOUSTIQUE CHEZ LE PERSONNEL TECHNIQUE DE L'AVIATION MILITAIRE ET SES CARACTERISTIQUES]

Giorgio Mazza *In* AGARD Med.-Legal Aspects of Aviation Sep. 1970 10 p refs In FRENCH; ENGLISH summary (See N71-11801 02-04)
Avail: NTIS

An audiological survey was conducted concerning technical personnel in service in three IAF Bases, with different types of aircraft: supersonic jets, conventional, and helicopters. The research was carried on a group of 340 subjects (aged 22-45). Their behavior was studied in regard to auditive acuity, by comparing the acoustic damage, evidenced under its different forms, to the most impostant parameters, requested for this study, in particular to the physical characteristics of noise. Author

N71-11814# Army Aeromedical Research Lab., Fort Rucker, Ala.

PILOT PERFORMANCE AND REFRACTIVE ERROR

John K. Crosley *In* AGARD Med.-Legal Aspects of Aviation Sep. 1970 6 p (See N71-11801 02-04)
Avail: NTIS

Conducted is a comparative evaluation of the performance of 113 students with refractive error as they progressed through primary rotary wing or primary fixed wing training. The achievement of students requiring corrective lenses was compared with that of a classmate who did not require lenses. The two broad areas of comparison were academic (classroom) achievement, and in-flight performance as rated by an instructor pilot. The results of this study show that there was no significant (alpha = .05) difference in the performance of these two groups of students throughout the first sixteen weeks of their flight training. Author

N71-11819# Army Aeromedical Research Lab., Fort Rucker, Ala.

RECENT ADVANCES IN PROVIDING EAR PROTECTION IN AVIATION CRASH PROTECTIVE HELMETS

Robert T. Camp, Jr. *In* AGARD Med.-Legal Aspects of Aviation Sep. 1970 6 p (See N71-11801 02-04)
Avail: NTIS

Summarized are sound attenuation characteristics of a large sample of ear protective devices. These data show not only the present state-of-the-art, but also establish a basis for the evaluation of ear protectors such as the U.S. Army APH-5 and the Navy SPH-3 helmets. Differences between attenuation values of the inefficient APH-5 and the superior Navy SPH-3 (Modified) demonstrate the recent advances in providing aviators with acoustically efficient helmets. Author

N71-11820# National Aeronautics and Space Administration, Washington, D.C.

NASA'S 1969 ADVANCED RESEARCH AND DEVELOPMENT IN AVIATION MEDICINE

Walton J. Jones *In* AGARD Med.-Legal Aspects of Aviation Sep. 1970 15 p (See N71-11801 02-04)
Avail: NTIS CSCL 05E

The Human Factors Systems Program of the National Aeronautics and Space Administration's Office of Advanced Research and Technology is pursuing an aggressive plan of research concerning the support and utilization of man in future aeronautical systems. It emphasizes the two most critical problems underlying the development of civil aviation, safety in air operations and noise control. It covers many items of interest to military aviation as well. Current research in these areas should have significant payoff within the next three to five years. New equipment under study will greatly increase the probability of survival in aircraft accidents. Investigations of pilot workload during all weather landing operations should reduce those accidents frequently attributed to pilot error. In the noise domain, we are studying both the physical characteristics of the noise environment and the psychoacoustic effects of exposure, all with an aim toward the development of improved noise control techniques. Author

N71-11822# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).

PHYSIOLOGICAL CONSIDERATIONS IN THE PREVENTION OF INSTABILITY IN OXYGEN BREATHING SYSTEMS

G. R. Sharp *In* AGARD Med.-Legal Aspects of Aviation Sep. 1970 12 p refs (See N71-11801 02-04)
Avail: NTIS

During the recent development of a pneumatic controlled miniature man-mounted oxygen breathing system, it was found that some preproduction regulators exhibited marked oscillation of delivery pressure instability. In order to eliminate this problem in final production regulators it has been necessary to modify test procedures to include a dynamic assessment of oxygen breathing system stability. Investigations were carried out in order to examine some of the physiological factors affecting the oscillatory behavior of these miniature systems. Human subjects breathed on a number of test miniature oxygen regulators which exhibited varying degrees of instability and it was found that the incidence and magnitude of oscillation of regulator delivery pressure depended mainly on the subject's level of pulmonary ventilation, the presence of speech and the proportion of breaths taken by nose. Analysis of inspiratory flow patterns using an analogue computer were carried out with subjects at rest, during light exercise and with speech during both activities. The results of this study suggested that the greater degree of instability which is found during light exercise and with speech, (at rest and during exercise) is related to the marked increase in inspiratory peak flow and rate of change of flow which was observed in these conditions. A second series of experiments were undertaken to measure respiratory impedance when sinusoidal oscillations of various frequencies were applied directly to the respiratory system with subjects carrying out pure nose and mouth breathing, at rest and during light exercise. It was shown that with applied oscillations, within the frequency range exhibited by unstable regulators, respiratory impedance is considerably higher with nasal breathing than with oral breathing. Author

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N71-11208# Royal Aircraft Establishment, Farnborough (England).

THE ANALYSIS OF GOLD-TANTALUM THIN FILMS

A. J. Christopher Mar. 1969 16 p refs

(RAE-TR-69038) Copyright. Avail: NTIS

A modified spectrophotometric method for the determination of 0 to 50 micrograms tantalum, using Brilliant Green, has been developed and applied to thin metallic films; gold was determined with thio-Michler's ketone. Gold may be determined alone, or in the presence of tantalum, on aluminium or glass substrates; tantalum may be determined alone on aluminium, but not on borosilicate glass substrates. The methods tried failed to allow the determination of tantalum or both tantalum and gold in composite films. Author

N71-11209# Naval Postgraduate School, Monterey, Calif.

THE PHOTOCHEMICAL DECOMPOSITION OF 1,3,5,7-TETRANITRO-1,3,5,7-TETRAZACYCLOOCTANE HMX

Jerry Bert Torbit (M.S. Thesis) Apr. 1970 39 p refs
(AD-711013) Avail: NTIS CSCL 7/5

This investigation was concerned with the photochemical decomposition of 1,3,5,7-tetranitro-1,3,5,7-tetrazacyclooctane (HMX). Products from ultraviolet irradiation of both solid-state HMX and HMX-acetone solutions were obtained and identified. On the basis of observed product variability with irradiation environment a new mechanism for the photochemical decomposition of HMX was postulated. Author (TAB)

N71-11210# Naval Ordnance Lab., White Oak, Md.

THE MICHAEL REACTION IN NON-ALKALINE MEDIA. 5: EFFECT OF STRUCTURE ON THE RATE AND MECHANISM OF ADDITION OF 1,1-DINITROCARBANIONS TO METHYL ACRYLATE

Lloyd A. Kaplan and Hugh B. Pickard 15 Jul. 1970 28 p refs
(AD-710991; NOLTR-70-78) Avail: NTIS CSCL 7/3

The kinetics of the addition of a series of substituted 1,1-dinitromethide ions to methyl acrylate were studied in 50% dioxane and in water. The requirement for acid catalysis in these Michael additions was defined as a lowering of the free energy of the transition state for the reversal of the initially formed carbanion RC(NO2)2CH2CHCO2CH3. This can be accomplished by a substituent R which is able to delocalize negative charge by a resonance interaction. For borderline cases, the rate of protonation of the carbanion RC(NO2)2CH2CHCO2CH3 may be a deciding factor in effecting a change from an acid catalyzed to an uncatalyzed reaction. A comparison of the specific rate and activation parameters for fluorodinitromethide ion with alkyl, chloro and hydrogen dinitromethide ions shows that the 2000-fold increase in rate for R = F is due to a 5 kcal./mo1 decrease in Delta H*. This enhanced nucleophilicity is attributed to a destabilization of an sp2-hybridized carbon by an alpha-fluorine substituent. Author (TAB)

N71-11211# California Univ., Berkeley. Dept. of Chemistry.

QUANTUM ORGANIC CHEMISTRY Final Report, 1 Oct. 1965 – 31 Mar. 1970

Andrew Streitwieser, Jr. Mar. 1970 34 p refs
(Grants AF-AFOSR-1002-66; AF-AFOSR-1364-68)
(AD-711100) Avail: NTIS CSCL 7/4

Experimental data obtained have been correlated with quantum mechanical calculations in the development of molecular orbital methods for application to organic systems. Experimental solvolysis rates were obtained for a variety of polycyclic arylmethyl p-toluensulfonates in acetic acid. The final sigma-plus values gave satisfactory correlations with SCF-pi methods. Experimental results on protodetritiations of aromatic hydrocarbons in trifluoracetic acid were combined with results in the literature to produce a consistent scale of aromatic electrophilic substitution reactivities for a wide variety of compounds. The pi-systems alone gave good correlations both with SCF-pi and CNDO methods. Author (TAB)

N71-11212# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Physics.

HEAT CAPACITIES OF Fe(HCOO)2-2H2O AND Ni HCOO 2.2 H2O BETWEEN 1/4 AND 20 K +

R. D. Pierce and S. A. Friedberg 1 Jul. 1970 32 p refs
(Contract N00014-67-A-0314-0006)
(AD-710814; TR-1) Avail: NTIS CSCL 7/4

The heat capacities of Fe(HCOO)2.2H2O and Ni(HCOO)2.2H2O have been measured between 1.4 and 20K. Peaks associated with long-range spin ordering are found at 3.74K for Fe(HCOO)2.2H2O and at 14.5K for Ni(HCOO)2.2H2O. An additional Schottky-like maximum occurs at 3K in the heat capacity of the nickel salt. These anomalies can be correlated with corresponding features of the observed magnetic susceptibilities. A unit cell of these salts contains two each of two inequivalent metal ions, types A and B. Author (TAB)

N71-11213# Air Force Office of Scientific Research, Arlington, Va. Directorate of Chemical Sciences.

FIFTEENTH ANNUAL CHEMISTRY PROGRAM REVIEW

Donald L. Ball and L. D. Whipple, eds. Jan. 1970 141 p refs
(AD-705264; AFOSR-69-3129TR) Avail: NTIS CSCL 7/4

The review provides a record of research in progress together with illustrative achievements resulting from the basic research program of the Directorate of Chemical Sciences, AFOSR (OAR). There are three main sections in the review. The first section presents highlights of chemical methods from the program and includes papers on kinetic methods, electrochemical methods, chemical lasers, trace element analysis, photoionization and photoelectron spectroscopy. The second section contains summaries of program statistics. The third section consists of factual summaries of each project completed during fiscal year 1969. Author (TAB)

N71-11214# Frankford Arsenal, Philadelphia, Pa.

SPECTROPHOTOMETRIC DETERMINATION OF CALCIUM IN ZIRCONIUM AND TITANIUM POWDERS

George Norwitz and Herman Gordon Aug. 1970 24 p refs
(AD-711883; FA-T70-9-1) Avail: NTIS CSCL 7/4

An accurate spectrophotometric method is proposed for the determination of calcium in zirconium and titanium powders by use of murexide. In the method a 0.4-gram sample is dissolved in hydrofluoric and sulfuric acids and the solution is evaporated to fumes of sulfuric acid. An ammoniacal precipitation is then made to precipitate the zirconium, titanium, and other elements, and an aliquot containing 0.2 gram of the sample is filtered. The ammonium salts are destroyed by treatment with nitric and hydrochloric acids and evaporation to dryness. The calcium is then determined spectrophotometrically using murexide. A study was made of the calcium murexide color and interferences. Author (TAB)

N71-11215# Naval Academy, Annapolis, Md.

THE PREPARATION AND CHARACTERIZATION OF NEW HETEROPOLY TUNGSTATES A Trident Scholar Project Report

Charles R. Skolds 15 May 1970 73 p refs
(AD-711290; USNA-TSP-11) Avail: NTIS CSCL 7/2

In 1965 the following unusual anion was prepared and characterized: (H2GaW11O40)(9-). This anion has been found to be very reactive toward transition metal ions. It has been utilized in the preparation of two new and very stable heteropoly anions which have the following formulations: (CuGaW11O40)(9-) (I); (MnGaW11O40)(9-) (II). Both the NH4-Na and the pure Na derivatives of these anions have been prepared and studied. The new compounds were analyzed for each constituent except oxygen. Other studies with these new compounds included x-ray diffraction and cryoscopy. The cubic, crystallographic cell of the NH4-Na derivative of anion (I) contains eight formula weights as required by its space group. The NH4-Na derivative of anion (II) crystallizes in the orthorhombic system. There are two formula weights in its crystallographic unit cell. Both anions (I) and (II) have the Keggin-type structure. Author (TAB)

N71-11216# North Carolina Univ., Chapel Hill. Dept. of Environmental Sciences.

THE EFFECT OF WATER VAPOR ON OZONE SYNTHESIS

IN THE PHOTO-OXIDATION OF ALPHA-PINENE

Lyman A. Ripperton and Daniel Lillian 19 Jun. 1970 35 p refs Presented at the 63rd Ann. Meeting Air Pollution Control Assoc., 14 – 19 Jun. 1970 Sponsored in part by PHS *Its* DESE UNC Publ. No. 237
(Grant NSF GA-1022)
(Rept-70-122) Avail: NTIS

A study of the effect of water vapor on the photochemical system NO2 plus alpha-pinene plus hv is reported. A hotpack environmental room provides a constant temperature chamber, a bank of ultraviolet and fluorescent lamps as a source of simulated solar radiation, and a 150-liter FEP Teflon bag as a reaction vessel are used. Representative concentrations of 10 pphm NO2 and 50 pphm alpha-pinene are used in a 3×2×2× factorial design where absolute humidities of dry air were varied. Matheson air was passed through a clean air train and used as the diluent. Nitrogen oxide was added to the reaction mixture by a permeation tube, and water and alpha-pinene by evaporation. Author

N71-11217# Joint Publications Research Service, Washington, D.C.

RIGA CHEMISTRY SYMPOSIUM, JUNE 1970

S. Giller 10 Nov. 1970 11 p Transl. into ENGLISH from Kommunist (Yerevan), no. 8, Aug. 1970 p 46 – 52
(JPRS-51762) Avail: NTIS

Symposium proceedings are reviewed and brief accounts are given of work in bio-organic chemistry, peptide and lipid chemistry, membrane biology, physicochemical biology, nucleic acid chemistry, and gene synthesis. E.C.

N71-11218# Army Weapons Command, Rock Island, Ill. Research and Engineering Directorate.

SYNTHESIS AND POLYMERIZATION OF beta-ALKYLSTYRENES

Ferrel E. Anderson Mar. 1970 33 p refs
(AD-711007; RE-70-128) Avail: NTIS CSCL 7/3

Work was continued on the synthesis of poly(beta-alkyl-p-styrene sulfonate) salt corrosion-inhibotors. A synthesis plan was followed which resulted in the synthesis of lauro-, palmito-, and stearophenone; octyl-, undecyl-, pentadecyl-, and heptadecyl-phenol-carbinol; beta-heptyl-, beta-decyl-, beta-tetradecyl-, and beta-hexadecyl-styrene; and poly(beta-heptyl- and beta-hexadecyl-styrene). Emphasis placed on the improvement of synthesis and analytical procedures resulted in significant progress. Results obtained from three polymerization attempts were useful in the solution of a major contamination problem encountered previously, but these results did not contribute to the formation of higher molecular weight problems. Author (TAB)

N71-11219# Georgia Inst. of Tech., Atlanta. Environmental Resources Center.

THE APPLICATION OF PHASE SELECTIVE ALTERNATING CURRENT POLAROGRAPHY TO THE ANALYSIS OF HEAVY METALS IN WATER Completion Report, 1 Jan. 1968 – 30 Jun. 1970

Peter E. Sturrock and Robert L. Poole, Jr. Jun. 1970 64 p refs Supported by Dept. of Interior
(PB-193412; ERC-0470; W70-08986) Avail: NTIS CSCL 07D

The suitability was investigated of phase selective alternating current polarography and square-wave polarography for analyzing water for low concentrations of heavy metal ions. The application of phase selective alternating current polarography for analysis of heavy metals in water is examined in detail. Use of square-wave polarography is examined to a lesser degree. A variety of heavy metal ions are examined and optimum conditions for analyzing the individual ions are documented. Conditions are given for analyzing various multicomponent mixtures. Problems due to interferences from surfactants on ac polarographic techniques and methods for eliminating interferences are set out. Both selective ac and square-wave polarography were suitable for water analysis. Square-wave polarography was the more sensitive. The selective ac technique was very suitable for analysis of multicomponent systems. Author (USGRDR)

N71-11220# Sussex Univ., Brighton (England). Chemical Lab.

STEREOCHEMISTRY OF REACTION AT GERMANIUM ATOMS Final Scientific Report, 1 Apr. 1966 – 30 Jun. 1970

Colin Esborn, Alan R. Bassindale, Richard A. Jackson, Catherine L. Turpin, and Ruth Walsingham Jul. 1970 40 p refs
(Contract AF 61(052)-930)
(AD-712371; ARL-70-0155) Avail: NTIS CSCL 7/3

The first optically active compounds containing germanium or silicon bonded directly to platinum have bn successfully synthesised: (+)R3GeH + cis(PMe2Ph)2PtHCl yields R3GePt(PMe2Ph)2Cl and (-)Me-1-NpPhSiH + cis(PMe2Ph)2PtCl2 yields Me-1-NpPhSi(PMe2Ph)2Cl. Although the absolute configuration of the products remains to be determined, these compounds are of potential importance in the advancement of our understanding of the mechanism whereby transition metals catalyse the addition of germanium and silicon hydrides to unsaturated aliphatic compounds. Optically stable solutions of R3GeLi have been prepared from the hydride (-)R3GeH in hexane. The structure and reactivities of a number of silicon-containing radicals have been studied by e.s.r. spectroscopy. Tris(trimethylsilyl)methyl, obtained by abstraction of bromine from (Me3Si)4CBr, is a relatively stable free radical, though not so stable as Ph3C. (Me3Si) 3C. has also been observed on photolysis of ((Me3Si)3C)2Hg. This is the first example of observation of an organic free radical produced by photolysis of an organomercurial. The quantum yields for decomposition of solutions of bis(trimethylsilyl) mercury in benzene or cyclohexane have been determined for light in the region of 4000A as 1.9 and 6.0 respectively. N.m.r. spectra of (Me3Si)2Hg in chlorobenzene showed that H-C-Si-199Hg satellites do not broaden appreciably over the range -16 to 104, indicating that trimethylsilyl groups are not exchanging rapidly between molecules even at 104 deg. Author (TAB)

N71-11221# Fulmer Research Inst., Ltd., Stoke Poges (England).

HEATS OF FORMATION OF GIBBSITE AND LIGHT ELEMENT DOUBLE OXIDES

P. Cross, J. Christie, and C. Hayman 1 Jul. 1970 41 p refs
(Contract F61052-70-C-0021)
(AD-711673; R.163/SR16; AFOSR-70-2335TR) Avail: NTIS CSCL 7/4

The heat of formation of gibbsite, from alpha-alumina and water, has been redetermined by solution calorimetry in hydrofluoric acid at 75C. A value of - 13.3 plus or minus 0.6kcal was found. The heats of combination of selected light element double oxides have also been determined by solution calorimetry in hydrofluoric acid at 75C. In the case of the double oxides that contained alumina, gibbsite was used as a reference compound. Author (TAB)

N71-11222# Georgia Inst. of Tech., Atlanta.

PREPARATION OF AMINOBORANE AND LOW TEMPERATURE MASS SPECTROMETRIC STUDIES OF ITS REACTIVITY AND ENERGETICS Interim Report

Chin Taik Kwon (Ph.D. Thesis) Aug. 1970 102 p refs
(Grant AF-AFOSR-1308-67)
(AD-711439; AFOSR-70-2316TR) Avail: NTIS CSCL 7/2

Aminoborane, H2BNH2, was synthesized by radio frequency discharge of borazine at 55 watts power level and -55C. The discharged borazine was quenched at -196C and aminoborane was separated from the unreacted borazine and other discharge products by vacuum distillation. Aminoborane was characterized by mass spectrometric techniques from -160C to -64C. The infrared spectrum of solid aminoborane was observed at liquid helium and liquid nitrogen temperatures. All spectra were identical, clearly resolving the N-H stretch at 3460 and 3367/cm and the B-H band at 2525 and 2445/cm. Aminoborane was observed to polymerize at about

-155C yielding an inert white solid. No attempts to characterize the polymer were made. Attempts to react H2BNH2 with tetrafluoroethylene, 1, 3-butadiene, 2-3-dimethyl-1 3-butaciene, vinylmethylether, diazomethane and ozone were unsuccessful. Halogenated derivatives of aminoborane were obtained with BCl3 but not with BF3 or HCl. Dichloroaminoborane and possibly monochloroaminoborane, ClHBNH2, were observed mass spectrometrically as products of the BCl3 and H2BNH2 reaction. The bond dissociation energy H2B-NH2 was calculated to be 182 kcal/mole using the measured appearance potentials of the fragmentations from aminoborane. Calculation of the heat of formation by two independent methods yielded values of -94 and -80 kcal/mole at 25C. Author (TAB)

N71-11223# Joint Publications Research Service, Washington, D.C.
STUDIES IN ELECTROCHEMISTRY
20 Oct. 1970 9 p refs Transl. into ENGLISH from Zh. Vses. Khim. Obshchestva Im. D. I. Mendeleeva (Leningrad), v. 15, no. 4, 1970 p 466–467, 470–471
(JPRS-51604) Avail: NTIS

CONTENTS:

1. OXIDATION OF n-XYLYLENEGLYCOL ON A ROTATING DISK ELECTRODE Ye. G. Bondarenko et al p 1–3 refs (See N71-11224 02-06)
2. CERTAIN REGULARITIES IN A SERIES OF VOLATILE INORGANIC HYDRIDES I. M. Osadchenko et al p 4–7 refs (See N71-11225 02-06)

N71-11224# Joint Publications Research Service, Washington, D.C.
OXIDATION OF n-XYLYLENEGLYCOL ON A ROTATING DISK ELECTRODE
Ye. G. Bondarenko et al *In its* Studies in Electrochem. 20 Oct. 1970 p 1–3 refs (See N71-11223 02-06)
Avail: NTIS

The polarization curves of the oxidation of n-xylyleneglycol on a rotating disk electrode of platinum and nickel in an aqueous sodium hydroxide solution are presented. The curves were recorded on a polarograph with an electronic compensating linear recording device. Before each measurement the electrode was cleaned with fine emery paper and placed in an electrolyzer filled with solution. The measurements show that the introduction of n-xylyleneglycol into the solution inhibits the evolution of oxygen, and the higher the concentration, the more positive the potential at which inhibition of oxygen evolution sets in. The results are used to find the conditions under which n-xylyleneglycol on a nickel anode is quantitatively oxidized into terephthalic acid. R.B.

N71-11225# Joint Publications Research Service, Washington, D.C.
CERTAIN REGULARITIES IN A SERIES OF VOLATILE INORGANIC HYDRIDES
I. M. Osadchenko et al *In its* Studies in Electrochem. 20 Oct. 1970 p 4–7 refs (See N71-11223 02-06)
Avail: NTIS

The regularities of the reduction potentials in a series of volatile inorganic hydrides are examined for elements in the main subgroups of the periodic system in order to determine the possibility of obtaining the hydrides electrochemically. The standard electrode potentials of hydride formation, calculated from thermodynamic data, and the potentials of reducing the elements to hydrides, determined polarographically, are given in tabular form. The data show that the standard potentials of hydride formation are usually shifted to the region of the more electronegative potentials with an increase in the atomic weight of the element in the main subgroups. The thermodynamic standard potentials are compared with the reduction potentials determined polarographically. The value of the difference between the standard and reduction potentials is shown to be dependent on the energy of dissociation of the reduced molecule into atoms. R.B.

N71-11226*# Electro-Optical Systems, Inc., Pasadena, Calif.
SPECTROSCOPIC STUDIES OF INTERSTELLAR GRAINS
Fred M. Johnson Washington NASA Nov. 1970 110 p refs
(Contract NASw-1803)
(NASA-CR-1667; EOS-4022) Avail: NTIS CSCL 03B

Results of an extensive experimental spectroscopic survey are presented directed towards laboratory simulation of 25 diffuse interstellar bands. Hundreds of compounds in a multitude of solvents were extensively studied. The Shpolskii matrix isolation technique was successfully used on a number of tetrabenzporphins of which the molecule bispyridyl magnesium tetrabenzo prophine (X) gave a fit to + or − 2A for 16 diffuse lines. In addition, good correlation with line width and intensitity was obtained for all lines. Additional corroborative evidence was obtained from IR absorption measurements on molecule X. An energy level diagram was constructed based on two excited electronic states where all 25 diffuse lines correspond to vibronic transitions, using the strongest measured IR lines. Implications of those results and the physical conditions under which these molecules are formed are discussed. Tabulations are given of experimental spectroscopic absorption and fluorescence data for a large variety of porphyrins studied under this program. Author

N71-11227 Texas Univ., Austin.
DOUBLE LAYER CAPACITANCE OF IRON AND CORROSION INHIBITION BY FURAN DERIVATIVES
Hariharan Vaidyanathan (Ph.D. Thesis) 1969 76 p
Avail: Univ. Mcrofilms: HC $4.20/Microfilm $3.00 Order No. 69-21899

The mechanism of iron dissolution and corrosion inhibition was investigated by galvanostatic polarization and electrical double layer capacitance measurements. Corrosion current measurements on zone-refined iron in perchloric acid solutions containing furan derivatives showed the inhibition efficiencies are in the following order: furoic acid > furfuryl amine > tetrahydrofurfuryl amine > > tetrahydrofurfuryl alcohol. This gradation is due to the relative electron donor properties of the functional groups involved which follow the same order as the inhibition efficiency. Apparent surface coverage calculations from the differential capacitance of iron indicated that for the same surface coverage, furoic acid is more inhibiting than the other furans studied. Dissert. Abstr.

N71-11228 Northwestern Univ., Evanston, Ill.
DECOMPOSITION IN VAPOR QUENCHED ALUMINUM-SILVER ALLOYS
Darrell Miller Erb (Ph.D. Thesis) 1969 91 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 70-47

A series of metastable aluminum-silver alloys ranging from 15 to 51 at. pct. Ag was prepared using the technique of vapor quenching. The pure elements were evaporated simultaneously from separate crucibles at a constant rate onto glass substrates at room temperature. By X-ray diffraction it was found that the solubility of silver in aluminum could be increased to at least 51 at. pct. Ag. With increasing silver content a transition was found at 33 at. pct. Ag which was characterized by (1) an increase in the lattice parameter normal to the surface, (2) a transition to a complete (111) texture, (3) increases in the (111) and (222) Bragg peak intensities, and (4) a tendency of the films to peel spontaneously from the glass substrates. It was found that the increase in the lattice parameter was the same for the (111) and (222) Bragg peaks and therefore was not due to the presence of stacking faults. Dissert. Abstr.

N71-11229# National Bureau of Standards, Washington, D.C. Analytical Mass Spectrometry Section.
ANALYTICAL MASS SPECTROMETRY SECTION: SUMMARY OF ACTIVITIES, JULY 1969 – JUNE 1970
William R. Shields, ed. Nov. 1970 120 p refs
(NBS-TN-546) Avail: SOD $1.25 Catalog No. C 13.46:546

The advances in instrumentation and the research activities of the Analytical Mass Spectrometry Section are reported for the period July 1969 to June 1970. Advances in instrumentation include the construction of a computer controlled mass spectrometer with appropriate interconnecting components, power supplies with greatly increased stability and the utilization of a magnetic field control. Elements studied during this period include: B, Cu, Ag, Pb, Tl, U, Pu, K, Rb, Ni and Mo. Chemical procedures are given for Cu, Ag, Pg, Tl, U, K, Rb, Ni and Mo. Mass spectrometric procedures are given for Pb, Tl, U, K, Ni and Mo. Chemical procedures for the intercomparison of redox standards are also given. Author

N71-11230*# California Univ., Santa Cruz. Div. of Natural Sciences.

STABILITIES OF NITROGEN CONTAINING HETEROCYCLIC RADICALS AND GEOMETRICAL INFLUENCES ON NONRADIATIVE PROCESSES IN ORGANIC MOLECULES

Progress Report, Jul. 1969 –Jul. 1970

Earl M. Evleth Jul. 1970 86 p refs
(Grant NGL-05-061-004)
(NASA-CR-111151) Avail: NTIS CSCL 07C

The research in the existence and electronic structure of the radicals of imidazole, pyrrole, benzimidazole and other related heterocyclics is presented. A theoretical investigation of the electronic structures of heterocyclic radicals based on the annihilation operator is given, and experimental studies in electron spin resonance are discussed. F.O.S.

N71-11231# Purdue Univ., Lafayette, Ind. Project Squid Headquarters.

NON-EQUILIBRIUM KINETICS: EXPLICIT TIME-DEPENDENCE OF PERTURBED DISTRIBUTION FUNCTIONS AND AUTO-CORRELATION EXPRESSIONS

Raymond Kapral (MIT, Cambridge), Suzanne Hudson (MIT, Cambridge), and John Ross (MIT, Cambridge) Jul. 1970 29 p refs Prepared in cooperation with MIT, Cambridge
(Contract N00014-67-A-0226-0005; Proj. Squid)
(AD-710748; SQUID-TR-MIT-54-PU) Avail: NTIS CSCL 7/4

The explicit time dependence of perturbed distribution functions is considered for a chemically reacting dilute gas mixture. The solutions obtained for the distribution functions approach in time the normal solutions of a Chapman-Enskog perturbation treatment within a few mean free times, and provide an auto-correlation expression for the first non-equilibrium correction to the rate coefficient for a bimolecular gas phase reaction. To illustrate the results, explicit solutions are obtained for two model systems. Author (TAB)

N71-11232 Louisiana State Univ., Baton Rouge.

ENERGY TRANSFER IN THE CHAR ZONE OF A CHARRING ABLATOR

Gary Charles April (Ph.D. Thesis) 1969 598 p
Avail: Univ. Microfilms: HC $27.00/Microfilm $7.60 Order No. 70-220

The energy transfer associated with the reacting flow of pyrolysis products through the char layer of a low density nylon-phenolic resin charring ablator is discussed. It is found that a non-equilibrium flow model, employing finite reaction rate data for the important reactions among the pyrolysis products, is necessary to accurately describe the energy transport within the char. The important reactions and kinetic data for a temperature range of 500 to 3000 F, with experiment simulation to 2300 F, are determined and incorporated into the mathematical model, called TEMPRE System. This model, in conjunction with experimental results obtained in a Char Zone Thermal Environment Simulator, is used to clearly show the shortcomings of the limiting cases of frozen and equilibrium flow in predicting the true behavior within the char layer. Dissert. Abstr.

N71-11233# Cincinnati Univ., Ohio.

MASS SPECTRA OF SOME SUBSTITUTED POLYFLUOROBENZENES Technical Report, Jan. - Dec. 1969

Arun K. Bhattacharya, Lee D. Smithson (AFML), and Christ Tamborski (AFML) Wright-Patterson AFB, Ohio AFML Jul. 1970 42 p refs
(Contract F33615-67-C-1565)
(AD-711072; AFML-TR-70-38) Avail: NTIS CSCL 7/3

The application of mass spectrometry, including precise mass measurements of molecular ions and selected fragment peaks, in determining the structure of various substituted polyfluorobenzenes is discussed. A high resolution mass spectrometer was used. It is shown that the nature of substituents, their size, position on the ring, and the completeness of fluorination are all vitally important in determining the fragmentation process. The rupture of the various carbon to halogens and carbon to hydrogen bonds are discussed. Interesting metastable peaks were found in some cases and their precursors were traced. For example, the following transition C6F5(+) to C5F3(+) + CF2 was found where the metastable peak appears at m/e 81.97. Author (TAB)

N71-11234# California Univ., Riverside. Dept. of Chemistry.

SYNTHESIS AND PROPERTIES OF COBALT COMPLEXES CONTAINING THE BIDENTATE PI-BONDING B8C2H10(-4) LIGAND

James N. Francis and M. Frederick Hawthorne 3 Aug. 1970 19 p refs Submitted for publication
(Contract N00014-69-A-0200-4019)
(AD-710758; TR-20) Avail: NTIS CSCL 7/2

The reaction of bis-(pi-(3)-1,2-B9C2H11)2Co(-1) with aqueous base at 100C and in the presence of added Co(+2) produced (in low yield) two polymetal complexes which contain the bidentate pi-bonding B8C2H10(-4) ion. The preparation and properties of these two complexes, (B9C2H11CoB8C2H10CoB9C2H11)(-2) and (B9C2H11CoB8C2H10CoB8C2H10-CoB9C2H11)(-3) are described. Author (TAB)

N71-11235* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

PROCESS FOR INTERFACIAL POLYMERIZATION OF PYROMELLITIC DIANHYDRIDE AND 1, 2, 4, 5-TETRAAMINO-BENZENE Patent

Vernon L. Bell, Jr., inventor (to NASA) Issued 30 Jun. 1970 (Filed 23 Nov. 1965) 6 p Cl. 260-78; Int. Cl. C08g20/32
(NASA-Case-XLA-03104; US-Patent-3,518,232;
US-Patent-Appl-SN-510155) Avail: US Patent Office CSCL 07C

The synthesis of polymers with high degrees of thermal and radiation stability is discussed. An aromatic tetracarboxylic dianhydride dissolved in a highly polar aprotic solvent is mixed with an equimolar quantity of a tetraamine dissolved in a similar solvent. The resulting mixture may be converted by either thermal or chemical means to fused ladder and partial ladder structures and recovered as a film or a fiber. P.N.F.

N71-11236* Notre Dame Univ., Ind.

SYNTHESIS OF POLYMERIC SCHIFF BASES BY SCHIFF-BASE EXCHANGE REACTIONS Patent

Gaetano F. D'Alelio, inventor (to NASA) Issued 1 Sep. 1970 (Filed 9 Nov. 1966) 9 p Cl. 260-72.5; Int. Cl. C08g9/06 Sponsored by NASA
(NASA-Case-XMF-08651; US-Patent-3,526,611;
US-Patent-Appl-SN-593594) Avail: US Patent Office CSCL 07C

Schiff-base polymers are prepared in tractable, high molecular weight form amenable to fabrication into useful articles by Schiff-base exchange reactions in which a difunctional Schiff-base is reacted with an aromatic diamine, an aromatic dialdehyde or another difunctional Schiff base. These reactions are designated as amine exchange, carbonyl exchange, and bis exchange. The polymerization reactions are carried out by heating a mixture of the reactants in a mono-functional Schiff-base, which serves as a reaction medium and moderator. P.N.F.

N71-11237* Midwest Research Inst., Kansas City, Mo.
PREPARATION OF ORDERED POLY(ARYLENESILOXANE) POLYMERS
Laurence W. Breed and Richard L. Elliott, inventors (to NASA) Issued 13 May 1969 (Filed 15 Sep. 1967) 4 p Cl. 260-46.5; Int. Cl. C08g47/02; Int. Cl. C09d3/82; Int. Cl. C07f7/02 Sponsored by NASA
(NASA-Case-XMF-10753; US-Patent-3,444,127;
US-Patent-Appl-SN-668751) Avail: US Patent Office CSCL 07C

The preparation of ordered poly(arylenesiloxane) polymers is discussed. The polymers exhibit favorable properties for materials applications in the aerospace field as coatings or elastomers for use in the space environment. The ordered polymers are stable to temperatures of 500 degrees C and exhibit resistance to radiation, along with other favorable properties such as film forming capability and elastomeric characteristics. P.N.F.

N71-11238* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
IMIDAZOPYRROLONE/IMIDE COPOLYMERS Patent
Vernon L. Bell, Jr. and George F. Pezdirtz, inventors (to NASA) Issued 6 Oct. 1970 (Filed 17 May 1967) 6 p Cl. 260-78; Int. Cl. C08g20/100
(NASA-Case-XLA-08802; US-Patent-3,532,673;
US-Patent-Appl-SN-640454) Avail: US Patent Office CSCL 07C

The production of copolymers synthesized from the reaction of dianhydrides and amine solutions is discussed. The class of polymers known as polyimidazopyrolones have a high resistance to thermal and radiative energy as well as excellent properties of shaped articles derived from the polymers. The polymers also display resistance to organic chemicals, acids, and bases. P.N.F.

N71-11239* Notre Dame Univ., Ind.
DIRECT SYNTHESIS OF POLYMERIC SCHIFF BASES FROM TWO AMINES AND TWO ALDEHYDES Patent
Gaetano F. D'Alelio, inventor (to NASA) Issued 23 Jun. 1970 (Filed 9 Nov. 1966) 5 p Cl. 260-72.5; Int. Cl. C08g9/06 Sponsored by NASA
(NASA-Case-XMF-08655; US-Patent-3,516,970;
US-Patent-Appl-SN-593593) Avail: US Patent Office CSCL 07C

Schiff-base polymers having the general formula =(HCArCH=NArN) sub n= where Ar is an arylene moiety were prepared by reacting an aromatic diamine of the formula H2NArNH2 with an aromatic dialdehyde of the formula OHCArCHO, an aromatic monoamine of the formula RNH2 and an aromatic monoaldehyde of the formula RCHO where R is an aryl radical. A mixture of the four reactants was heated to 250 to 300 C to produce a fusible black polymer. Heating to higher temperatures removed by-product monofunctional Schiff base and converted the polymer to infusible form. Polymers with this structure exhibit outstanding heat resistant properties and can withstand temperatures in excess of 400 C for sustained periods without undergoing significant degradation or phase changes. Schiff-base polymers offer an attractive material for applications in the aerospace field as well as for other uses requiring high temperature stability. A.L.

N71-11240* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SYNTHESIS OF SILOXANE-CONTAINING EPOXY POLYMERS Patent
William J. Patterson, inventor (to NASA) Issued 23 Jun. 1970 (Filed 26 Mar. 1968) 7 p Cl. 260-46.5; Int. Cl. C08f11/04
(NASA-Case-MFS-13994-1; US-Patent-3,516,964;
US-Patent-Appl-SN-715975) Avail: US Patent Office CSCL 07C

Siloxane containing epoxy polymers were prepared by reacting siloxane containing diepoxides with aromatic diamines having siloxane groups. By varying the amount of siloxane groups in the reactions the mechanical and electrical properties of the crosslinked polymer can be controlled. Polymers having a low dielectric constant, consistent with favorable mechanical and thermal properties, can be obtained by this process and are favorable for use as encapsulating or packaging materials for electronic assemblies. The use of siloxane containing amines as curing agents also eliminates the incompatibility problem encountered with the amines previously used. Methods for preparation of the reactant monomers are also discussed. A.L.

N71-11241# State Univ. of New York, Stony Brook. Dept. of Chemistry.
OSMOTIC PROPERTIES OF DIVALENT METAL POLYSTYRENESULFONATES IN AQUEOUS SOLUTION
M. Reddy, J. A. Marinsky, and A. Sarkar 1970 34 p refs
(Contract AT(30-1)-2269)
(TID-25459) Avail: NTIS

Molal osmotic coefficients of aqueous solutions of divalent polystyrenesulfonates have been measured over a large concentration range using two experimental methods: vapor pressure osmometry and isopiestic equilibration. The osmotic coefficients of various divalent polystyrenesulfonates were practically independent of concentration in the low concentration region (0.04 to 0.5 m); at higher concentrations the osmotic coefficients increased rapidly with concentration, eventually becoming greater than unity. The osmotic coefficient of zinc polystyrenesulfonate increased most rapidly with concentration while that for strontium polystyrenesulfonate increased most slowly. The osmotic coefficients at low concentrations are in agreement with theoretically-based predictions. At high concentrations the osmotic behavior is remarkably similar to that exhibited by the divalent metal perchlorates over the same concentration range. A most interesting and important observation is the equivalent osmotic properties of the crosslinked polystyrenesulfonate ion-exchange resin and its linear polyelectrolyte analogue. Author

N71-11242* Notre Dame Univ., Ind.
AZINE POLYMERS AND PROCESS FOR PREPARING THE SAME Patent
Gaetano F. D'Alelio, inventor (to NASA) Issued 3 Feb. 1970 (Filed 9 Nov. 1966) 6 p Cl. 260-205; Int. Cl. Co8g33/02, 53/08 Sponsored by NASA
(NASA-Case-XMF-08656; US-Patent-3,493,524;
US-Patent-Appl-SN-593605) Avail: US Patent Office CSCL 07C

The preparation of azine polymers for fabricating such articles as composite heat shields is described. Polymers having the formula =(HCArCH=N-N)sub n= where n is at least 5 and Ar is an arylene moiety are prepared in fusible tractable, high molecular weight form by reacting an azine with an aromatic aldehyde. The azine is RCH=N-B=CHR where R is an aryl moiety, and the aldehyde is OHCArCHO or the Schiff base RN=CHArCH=NR. The reactants are heated to 200 to 260 C in an inert atmosphere, and further heating to 280 to 450 C produces an infusible material with high thermal stability. The polymer produces gaseous nitrogen and a stable polymeric residue when subjected to thermal decomposition. The carbonyl exchange, Schiff base exchange, and polystilbene preparation are described. N.E.N.

N71-11243* Notre Dame Univ., Ind.
SYNTHESIS OF POLYMERIC SCHIFF BASES BY REACTION OF ACETALS AND AMINE COMPOUNDS Patent
Gaetano F. D'Alelio, inventor (to (NASA) Issued 3 Feb. 1970 (Filed 9 Nov. 1966) 8 p Cl. 260-2, Int. Cl. Co8g9/06 Sponsored by NASA
(NASA-Case-XMF-08652; US-Patent-3,493,522;
US-Patent-Appl-SN-593606) Avail: US Patent Office CSCL 07C

The preparation of Schiff base polymers for fabricating such articles as composite heat shields is described. Polymers having the formula =(HCArCH=NArN)sub n= where Ar is an arylene moiety are prepared in tractable, high molecular weight form by reacting an acetal with an amine. The acetal is (RO)2HCArCH(OR)2 where R is an allyl group, and the amine is difunctional H2NArNH2, acylamine RCOHNArNHOCR, or Schiff base RHC=NArN=CHR. The reactants are heated to 250 or 300 C in a monofunctional Schiff base medium, such as benzilidene aniline. Further heating in the presence of a Lewis acid converts the polymer to a black, infusible material with a high degree of thermal stability. To fabricate heat shields, the fusible polymer is intermingled with reinforcing fibers such as fiber glass, boron, or silica, and the composite is compressed and heated to 400 to 600 C. The preparation of Schiff base polymers by the acetal-amine reaction the acetal-acylamine reaction, and the acetal-Schiff base reaction are described. N.E.N.

N71-11730*# Grumman Aerospace Corp., Bethpage, N.Y.
CHEMICAL REACTION IN LOW AND ZERO GRAVITY: A FEASIBILITY STUDY
John Fogarty and Sidney Butner *In* NASA. Marshall Space Flight Center Space Process. and Manufacturing 21 Oct. 1969 p 469–491 refs (See N71-11701 02-15)
Avail: NTIS CSCL 07D

Presented are the results of a theoretical study to determine the effects of low and zero-gravity on chemical reactions, specifically catalytic polymerization of ethylene using transition metal complexes. Fixed bed, slurry reactor, and fluidized bed polymerization processes are compared under earth gravity and low or zero gravity conditions. Fixed bed polymerization under low or zero gravity does not offer any particular advantages or disadvantages compared to normal gravity processing. Author

N71-11731*# California Univ., Los Angeles.
INDUSTRIAL CHEMISTRY IN SPACE
W. F. Libby and Patrick Payton *In* NASA. Marshall Space Flight Center Space Process. and Manufacturing 21 Oct. 1969 p 402–498 (See N71-11701 02-15)
(Grants NGL-05-007-003; AF-AFOSR-1255-68)
Avail: NTIS CSCL 07A

Chemical manufacture relates to a space environment as it relates to air-free chemical preparation. For example, oxygen-free copper would be a premium product. Author

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N71-11244*# TRW Systems Group, Redondo Beach, Calif. Communication and Sensor Systems Dept.
ANTENNA AND PROPAGATION STUDIES FOR SPACECRAFT TASK E-53F: AN ANALYSIS OF THE RANGING SYSTEM FOR THE LUNAR SURFACE ELECTRICAL PROPERTIES EXPERIMENT
J. D. Osborn 13 Oct. 1970 15 p refs
(Contract NAS9-8166)
(NASA-CR-108673) Avail: NTIS CSCL 17I

An analysis of a ranging system which has been proposed for use on the Surface Electrical Properties (SEP) Experiment is presented. The proposed ranging system measures range by measuring the power level of the received signal, and it measures azimuth angle by comparing the phase of a signal received from a rotating antenna beam to that of a marker pulse received from a non-rotating beam. The phase difference between these two signals is a measure of azimuth angle. The method for generating the rotating beam is discussed. The experiment in the deployed configuration using the above ranging system is illustrated where the receiver is shown mounted on the Lunar Rover Vehicle (LRV). If the LRV is used in the experiment, the range will be extended out to a maximum of 10 km. Power measurements for determining range and phase measurements for determining azimuth angle are made at the frequencies used for electromagnetic detection, so no separate antenna is required for either function. Author

N71-11245*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STATION KEEPING OF HIGH POWER COMMUNICATION SATELLITES
Robert R. Lovell and Thomas A. O'Malley Washington Nov. 1970 71 p refs
(NASA-TM-X-2136; E-5760) Avail: NTIS CSCL 17B

Station-keeping requirements are determined for a class of high-power communication satellites in synchronous equatorial orbit. These satellites are characterized by large, sun-oriented solar arrays. The perturbing forces on the satellite are the gravitational effects of the sun and moon, the triaxial mass distribution of the earth, solar radiation pressure, and RF radiation pressure. The area-to-mass ratio of these satellites is sufficiently high that the station-keeping requirements due to solar radiation pressure must be considered. Author

N71-11246# Aerospace Corp., El Segundo, Calif. Office for Development Planning.
INTERMODULATION OF SATURATING TRANSFER DEVICES **Research Report, Feb. 1969 – Feb. 1970**
Charles S. Lorens 14 Aug. 1970 49 p
(Contract F04701-70-C-0059)
(AD-711374; TR-0059(6510-06)-1; SAMSO-TR-70-289) Avail: NTIS CSCL 9/4

The paper develops a set of high-frequency saturating polynomial transfer models, the results of testing these models with two equal signals separated slightly in frequency, and the resultant ratio of inband intermodulation power to linear signal power in the case of a uniformly distributed spectrum. The models are useful in the examination of intermodulation products at power levels below and in the neighborhood of saturation. Saturation is defined as the first maximum in the one-signal power transfer characteristic. The models are correspondingly normalized by the output saturation power and the linearly amplified input power which produces this output saturation power. Testing these models with two equal signals separated slightly in frequency produces a significant indication of the linear degree of the transfer device and an indication of the ratio of intermodulation power to linear amplified signal power in the case of a uniformly distributed spectrum. Author (TAB)

N71-11247# Motorola, Inc., Scottsdale, Ariz. Government Electronics Div.
TACTICAL SITUATION DISPLAY GROUP AN/USA-28(V)2 **Final Technical Report, 9 Apr. 1968 – 23 Mar. 1970**
Richard A. Ruppel, Fred G. Keiner, James A. Grube, and Frank J. Arkell Griffiss AFB, N.Y. RADC Aug. 1970 86 p
(Contract F30602-68-C-0329)
(AD-712110; RADC-TR-70-138) Avail: NTIS CSCL 9/5

The purpose of the effort was to develop a fully qualified display console capable of satisfying both the data management and radar display requirements. This effort was undertaken to remove the limitations of available display hardware including sheer weight, bulk, power, operating availability and performance which inhibit their direct application to tactical and airborne environments. The 16 in. Modular Display Tactical (MDT) assures the AF an optimum, yet flexible, display capability thru a hardware design

incorporating the most recent advances in display technology. The report covers the design and development of the 16 in. Modular Display unit. This developmental model is a high performance, flexible display unit which can be configured by the addition of a variety of functional modules to meet user requirements ranging from a high speed radar display combining raw video with processed tracking information to a full scale data management configuration. The unit features a high speed digital sweep (10 megabits per second, 12 bit resolution), a 4.6 microsecond average character writing speed, and 15 microsecond positioning time per CRT diameter with a low power deflection system. These characteristics are combined in a lightweight package ranging from 90 lbs to 99 lbs.
Author (TAB)

N71-11248*# Computer Transmission Corp., Los Angeles, Calif.
FORMULATION OF DESIGN RULES FOR PCM TELEMETRY FRAME SYNCHRONIZATION Final Report
10 Oct. 1970 93 p refs
(Contract NAS5-21196)
(NASA-CR-111391) Avail: NTIS CSCL 09F

The objective of the material presented is to produce easily understandable and readily applicable design rules for choosing frame synchronization codes and associated parameters for PCM telemetry systems. The design rules are based upon an extensive experience survey to assure that all known operational problems associated with frame synchronization are solved. The resulting rules are based upon experience, the results of a previous GSFC study, and the analyses of this report.
Author

N71-11249# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
DESCRIPTION AND FLOW CHART OF THE PDP-7/9 COMMUNICATIONS PACKAGE
Philip W. Ward Jul. 1970 62 p
(Contracts Nonr-4102(01); F33615-69-C-1341)
(AD-711379; MAC-TM-11) Avail: NTIS CSCL 17/2

The PDP-7/9 Communications Package was written to provide data transfers between the buffer controller (PDP-7 or PDP-9) of an ESL Display Console and a host computer via a 50-kilobit serial telephone link using Bell System Type 303 Dataphones. This memorandum describes the package programs and calling procedures, and includes detailed flow diagrams.
Author (TAB)

N71-11250# Naval Research Lab., Washington, D.C. Radar Div.
MILLIMETER AND SUBMILLIMETER WAVE APPLICATIONS
Merrill I. Skolnik 12 Aug. 1970 42 p refs
(AD-712055; NRL-MR-2159) Avail: NTIS CSCL 17/9

The report discusses the advantages and limitations of this frequency region and reviews the potential applications under the categories of radar, communications, radiometry and instrumentation. One of the problems of operating in this frequency range is that some of the advantages can also be considered as limitations. Even if transmitter powers and receiver sensitivities were the same as those obtained at microwaves, it would be unlikely that millimeter and submillimeter wave systems could compete with most of the major applications of microwaves. Successful applications of the shorter wavelengths will probably utilize characteristics that are distinct from those of microwaves. The special attributes of millimeter and submillimeter waves are narrow beamwidth with reasonably-sized apertures, wide bandwidth, and interactions with the constituents of the atmosphere and other gases. The more likely candidates for applications unique to this frequency range include remote sensing of the environment, interference-free communications and radar, low-angle radar tracking, high-resolution and imaging radar, extremely wideband communications, plasma diagnostics, and spectroscopy. If systems applications occur it seems more likely that they would be found initially at frequencies below 50 GHz rather than at the higher frequencies. At the present time, there does not seem to be imminent major systems applications of these wavelengths.
Author (TAB)

N71-11251# Environmental Technical Applications Center (Air Force), Washington, D.C.
HOOK ECHOES ON RADAR
John W. Stryker Aug. 1970 18 p refs
(AD-711794; ETAC-TN-70-8) Avail: NTIS CSCL 17/9

A great amount has been published on both tornado activity and hook echoes on radar. This paper discusses one popular tornado theory and explains the existence of the hook echo on radar. The tornado model used is that developed by the late Dr. Fred Bates. On the basis of the tornado theory, a steady-state storm develops with a rotating updraft at the center of the storm. The potential for tornadic development is on the convergent or windward side of the cell. The hook echo as viewed on radar, while not assumed to be the tornado itself, has an extremely high correlation with tornado occurrence or funnel cloud sightings. The question posed then is: What is this hook echo and how is it associated with the tornadic vortex. By using the model in the Bates Theory, a satisfactory conclusion can be derived.
Author (TAB)

N71-11252# Army Electronics Command, Fort Monmouth, N.J. Radar Technical Area.
BROADBAND HORNS
John L. Kerr Aug. 1970 87 p refs
(AD-712299; ECOM-3319) Avail: NTIS CSCL 9/5

The report describes the development of two very broadband horn antennas using double-ridged waveguide techniques. The first design accomplished was that of a feed horn to be used to illuminate a six-foot parabolic reflector over the frequency range from 1 GHz to 12 GHz. Pattern data show that the beamwidth of this horn design rapidly becomes narrower than would normally be considered acceptable for that purpose. However, that was considered to be useful for the intended application since it was required that the half-power beamwidth from the six-foot parabola not become less than two degrees. That indicates that only one half of the reflector should be illuminated at the upper frequency limit. The second development consisted of designing a larger horn with a nominal gain of approximately 15 db and with a significant requirement that the gain variation be held to a minimum over the frequency range. The technique used to reduce the gain variation consisted of using relatively large flare angles to introduce increasingly greater phase error with increasing frequency and thus reduce the aperture efficiency. Electrical performance characteristics are presented for the two horn designs as well as data measured with the feed horn illuminating a six-foot parabolic reflector.
Author (TAB)

N71-11253# Army Materiel Systems Analysis Agency, Aberdeen Proving Ground, Md. Research and Development.
A SURVEY OF DIGITAL WAVEFORM ENCODING METHODS FOR SPEECH
Donald Charles Martin (N. C. State Univ., Raleigh) Apr. 1970 68 p refs
(AD-712304; AMSAA-TM-67) Avail: NTIS CSCL 9/4

Digital encoding methods for speech are surveyed with emphasis placed on system descriptions rather than on mathematical analyses. The objective is to give an overall view of the topic, stressing pulse code modulation (PCM) and differential pulse code modulation (DPCM) with delta modulation treated as a special case of the latter.
Author (TAB)

N71-11254# Stanford Univ., Calif. Electronics Lab.
TRANSHORIZON PROPAGATION TECHNIQUES Quarterly Report, 20 Feb. – 19 May 1970
A. T. Waterman, Jr. Jul. 1970 13 p
(Contract DAAB07-70-C-0138)
(AD-711561; SU-SEL-70-030; ECOM-0138-1; QR-1) Avail: NTIS CSCL 20/14

The report deals with research on propagation of microwaves between two points on earths surface separated a distance considerably beyond line of sight. The frequency used is 3.2 GHz. The receiving system employs an antenna array which permits wave front sampling. Propagation measurements are supplemented by meteorological measurements 0.9 temperature, humidity turbulence etc. Profiles of refractive index are obtained by flying a plane equipped with a microwave refractometer through the atmospheric path in which the signal is scattered. Author (TAB)

N71-11255*# General Electric Co., Schenectady, N.Y. Research and Development Center.
ATS RANGING AND POSITION FIXING EXPERIMENTS Progress Report, 1 May–31 Jul. 1970
31 Jul. 1970 43 p refs
(Contract NAS5-11634)
(NASA-CR-111392; S-70-1094) Avail: NTIS CSCL 17I

The ground reference transponder at Gander, Newfoundland was used together with the Radio-Optical Observatory at Schenectady, New York to perform a twenty-four hour ranging test. Signals transmitted from the Radio-Optical Observatory were relayed by ATS-3 and range measurements were made from the satellite to the Gander ground reference transponder as well as to the Observatory at Schenectady. The results showed that the difference between the measured and computed slant ranges could be used as a first order correction for ionospheric delay and satellite position uncertainty to correct the range measurements from the satellite to Gander. Gander is approximately 900 miles east-northeast. When the Schenectady-derived corrections were applied to the Gander range measurements, allowing for a difference in the local times of the two locations, approximately 3000 latitude determinations for the Gander transponder were all within + or – 1 nautical mile of the true position of the transponder. A two-hour period of severe scintillation was experienced during the twenty-four hour test. Author

N71-11256# Cybernetic Research and Development Corp., Princeton, N.J.
ADVANTAGES OF QUICK-LOOK PATTERN RECOGNITION IN AIR FORCE SIGNAL ANALYSIS Final Report
Alfred Engel and David M. de Ferranti 24 Aug. 1970 70 p ref
(Contract F44620-70-C-0090)
(AD-712102; AFOSR-70-2409TR) Avail: NTIS CSCL 17/2.1

Up to 100 time slices and 10 harmonics of visible speech are derived from one single Fourier series. The method assumes a signal-to-noise ratio of better than 1 to 10. Emphasis has been put on both beat frequency enhancement and carrier suppression. Execution times close to real time were achieved on an IBM 360 Mod 91. Program listings appended to report. Author (TAB)

N71-11257# Radio Corp. of America, Moorestown, N.J. Missile and Surface Radar Div.
AN/PPS-18 (XN-1) ULTRA RELIABLE RADAR Interim Development Report, 1-31 Jul. 1970
J. D. Frattura 7 Aug. 1970 17 p refs
(Contract N00039-70-C-3502)
(AD-711363) Avail: NTIS CSCL 17/9

The program covers the study, design, construction, test analysis and inspection of a complete and operative, highly reliable, relatively failure-free version of the pulsed doppler surveillance AN/PPS-6 radar set. The radar set is intended to be a lightweight, miniaturized, X-band, pulse doppler combat surveillance radar. The basic purpose of this program is to develop a highly reliable radar set considering the overall cost of ownership when development, production and maintenance costs are taken into account while keeping the same general performance, form-factor and weight as the AN/PPS-6 radar. Author (TAB)

N71-11258# Technische Hogeschool, Eindhoven (Netherlands).
FREQUENCY-INDEPENDENCE AND SYMMETRY PROPERTIES OF CORRUGATED CONICAL HORN ANTENNAS WITH SMALL FLARE ANGLES
Martinus Elisabeth Johannes Jeuken (Ph.D. Thesis) 8 Sep. 1970 148 p refs
Avail: NTIS

Feeds for reflector antennas, frequency independent conical horn antennas, and conical horn antennas with symmetrical radiation patterns are reviewed. The power radiation patterns of corrugated conical horn antennas with a small flare angle and a small circular aperture are investigated. The frequency independent properties of the conical horn antenna with perfectly conducting boundary were obtained. J.A.M.

N71-11259# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
FOUR SMALL ANGLES SIGNIFICANT FOR RADIO PROPAGATION Technical Memorandum
E. Shotland Mar. 1970 43 p refs
(Contract NOw-62-0604-C)
(AD-711946; APL-TG-1105) Avail: NTIS CSCL 17/2.1

Four small angles play a significant role in some radio propagation problems, especially when polarization is vertical: (1) the wave tilt of the electrical vector of the total field in the interference region, (2) the wave tilt of surface waves, (3) Brewsters angle and (4) Nortons limiting angle. Author (TAB)

N71-11260# Rome Air Development Center, Griffiss AFB, N.Y.
COMPARATIVE PERFORMANCE EVALUATION OF COMMON AND SPECIAL GRADE AUTOVON TRUNKS, PHASE 1 Final Technical Report
Russell J. Lemon Sep. 1970 105 p refs
(AD-712367; RADC-TR-70-199) Avail: NTIS CSCL 71/2

A quantitative evaluation of Special Grade and Common Grade AUTOVON Trunks was conducted using the RADC Digital Communications Experimental Facility (DICEF). The results provide factual data on the performance of these circuits and conclude that Common Grade AUTOVON Trunks with fixed compromise equalization are comparable in performance to the Special Grade Trunks. Digital Tests were performed at a data rate of 2400 bits per second. Analog Tests of amplitude and relative delay vs frequency, signal to noise ratio, frequency translation and phase jitter were also performed. Author (TAB)

N71-11261# Stanford Univ., Calif. Electronics Labs.
A RADIO ACOUSTIC SOUNDING SYSTEM FOR THE REMOTE MEASUREMENT OF ATMOSPHERIC PARAMETERS
James M. Marshall Aug. 1970 158 p refs
(Contract AF 19(628)-6152)
(AD-712352; SU-SEL-70-050; AFCRL-70-0438; SR-1) Avail: NTIS CSCL 17/1

A technique for the remote measurement of wind velocity, turbulence, and air temperature is presented. Regions of the atmosphere are remotely sensed using velocity information obtained via coherent scattering of electromagetic energy from an acoustic wave traveling through the atmosphere. The fundamental scattering relations are derived for a non-turbulent atmosphere. Scattering relations for the effect of wind and temperature gradients on system performance are also derived. The basic considerations involved in the design of a RASS terminal are discussed. An experiment performed to verify the scattering relations derived and to determine the limitations imposed by a turbulent atmosphere is described. Usable signal-to-noise ratios were obtained reliably to scattering heights of 1.5 km. Author (TAB)

N71-11262# George Washington Univ., Washington, D.C. School of Engineering and Applied Science.
PRINCIPLES FOR THE DESIGN AND SELECTION OF MODEMS
Abdelaziz Fadlaoui and Robert B. Heller Aug. 1970 287 p refs
(Contract N00014-67-A-0214-0003)
(AD-712125) Avail: NTIS CSCL 9/5

The report presents a study of the principles for the design and performance of modems (data sets) used in the transmission of data over voice bandwidth channels. Its purpose is to help assist in the evaluation and selection of modems. Author (TAB)

N71-11263*# Clark (David) Co., Inc., Worcester, Mass.
COMMUNICATIONS CARRIER ASSEMBLY, MODEL A-3C
Final Report
Joseph A. Ruseckas and Anthony F. Plante Jul. 1970 14 p
(Contract NAS9-7976)
(NASA-CR-111572) Avail: NTIS CSCL 17B

The design, development, and evaluation of a communications carrier for spacecrew personnel is discussed. The carrier consists of a skull cap which supports the communications equipment when worn by the astronaut. The specifications of the equipment and modifications to improve the comfort and utility of the carrier are presented. Author

N71-11264# General Instrument Corp., Hicksville, N.Y. Electronic Systems Div.
RADAR SET AN/PPS-17: FAILURE FREE DEVELOPMENT PROGRAM Interim Development Report, 1-31 Jul. 1970
Walte Seidman and Al Zecca 31 Jul. 1970 22 p refs
(Contract N00039-70-C-3501)
(AD-711336; Rept-1158-IR-6) Avail: NTIS CSCL 17/9

The report describes the progress made toward the design, fabrication, and evaluation of the AN/PPS-17 High Reliability Radar. The basic objective of the program is to develop and evaluate a radar set specifically designed for high reliability and for minimum life cycle cost. Author (TAB)

N71-11265# Naval Submarine Medical Center, Groton, Conn. Submarine Medical Research Lab.
SUBGLOTTAL PRESSURE AND AIR FLOW MEASURES DURING VOCAL FRY PHONATION
Thomas Murry 30 Jan. 1970 13 p refs
(Grants NIH NB-05475; NIH MB-06459)
(AD-711808; SMRL-611; Rept-4) Avail: NTIS CSCL 17/2

The purpose of the study was to determine the subglottal pressures and rates of air flow produced during vocal fry phonation, a type of low frequency phonation characterized by a distinct popping sound. Simultaneous recordings of the voice signal, intratracheal air pressure, and rate of air flow, were obtained from five adult male subjects during three sustained phonations of the vowels /a/ and /i/ at three regions within their vocal fry range and two within their modal(mid)phonational range. The data were analyzed in terms of means fundamental frequency, mean subglottal pressure, and mean rate of air flow. The results indicate that the subglottal pressures produced during vocal fry phonation are significantly greater than those produced at adjacent low frequencies in modal range. In addition, it was shown that as the repetition rate of vocal fry increases, subglottal pressure tends to increase. Subglottal pressure decreased between the 10 and 30 percent frequencies of the modal phonational range. The subglottal pressures produced during phonation of /a/ and /i/ at any one vocal fry or modal phonation condition were not significantly different; although those for the /i/ tended to be slightly larger than for /a/. Furthermore, there was no difference in the subglottal pressure accompanying phonation of the vowel /a/ as a result of inserting a mouthpiece into the subjects mouth to record air flow. Rate of air flow was found to be significantly lower in fry phonation and no relationship between flow rate and frequency in both ranges was found. Author (TAB)

N71-11266* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ADAPTIVE COMPRESSION OF COMMUNICATION SIGNALS Patent
Wilford E. Sivertson, Jr., inventor (to NASA) Issued 21 Apr. 1970 (Filed 31 Oct. 1966) 12 p Cl. 325-42; Int. Cl. H04b1/66; Int. Cl. H04n7/00
(NASA-Case-XLA-03076; US-Patent-3,508,152;
US-Patent-Appl-SN-591004) Avail: US Patent Office CSCL 17B

A method is described for improving the efficiency of a pulse code modulated communication system by employing an adaptive variable resolution encoding technique. Compression ratios are automatically changed as the quality of the transmitted signal changes and the level of pseudo-random noise corresponding to each compression ratio is added to the transmitted signal prior to encoding. The technique obtains positive mixed number as well as positive integer compression ratios. A processor is required at the receiving station as well as the transmitting station and can be used for reducing the channel capacity required for transmitting television signals between two physically separated stations. Block diagrams of transmitting and receiving systems utilizing the technique and the adaptive compression pseudo-random noise processor are included. J.M.

N71-11267* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
REFLECTOMETER FOR RECEIVER INPUT IMPEDANCE MATCH MEASUREMENT Patent
Charles T. Stelzried, inventor (to NASA) Issued 21 Apr. 1970 (Filed 27 Jun. 1967) 5 p Cl. 325-363; Int. Cl. H04b1/18
Sponsored by NASA
(NASA-Case-XNP-10843; US-Patent-3,508,156;
US-Patent-Appl-SN-649358) Avail: US Patent Office CSCL 17B

A microwave, low-noise receiver input system with a reflectometer as an integral part is described. A receiver is coupled to an antenna through a directional coupler to inject signals from a separate source into the receiver for receiver gain measurements. A two position switch is provided between the source and the directional coupler which directs the signal toward or away from the receiver. When the signal is directed away from the receiver, some will be reflected back into the receiver due to any impedance mismatch. The difference in its output when signals are either reflected or incidentally received is a measure of impedance mismatch. J.M.

N71-11268# European Space Research Inst., Frascati (Italy).
HIGH-FREQUENCY AURORAL NOISE
N. D'Angelo [1970] 15 p refs
Avail: NTIS

The suggestion is advanced that the high-frequency auroral noise (in the approximately 1 MHz to approximately 1000 MHz range), observed at times on ground receivers, may originate from short wavelength electrostatic oscillations excited in the auroral ionosphere by beams of fast protons. The energy coupling between the electrostatic oscillations and the electromagnetic waves detected on the ground is estimated on the basis of existing theories. Author (ESRO)

N71-11269 Pennsylvania Univ., Philadelphia.
DETECTION OF STATIONARY TARGETS IN THE GROUND CLUTTER ENVIRONMENT
Robert Arnold Ternus (Ph.D. Thesis) 1969 198 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 69-21438

The radar signal processing techniques of coherent pulse train integration, noncoherent pulse train integration, optimum filtering, pulse compression, and frequency agility can be utilized to enhance an airborne radar's capability to detect stationary ground targets. An analytical evaluation procedure for comparing the effectiveness of these techniques is developed based on detection probabilities for complex and point targets. The evaluation procedure consists of inserting the clutter, radar, and aircraft flight characteristics into the computer program and then, on the basis of the program output, calculating target detection probabilities for various target cross sections. Different radar system configurations can be compared on the basis of the target cross section required to obtain a given detection probability or on the basis of detection probabilities for a specified target cross section. Dissert. Abstr.

N71-11270*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.

CASCADED TREE CODES

John L. Ramsey (Ph.D. Thesis) 1 Sep. 1970 112 p refs
Supported in part by Stanford Res. Inst., Menlo Park, Calif.
(Grant NGL-22-009-013; Contract DA-28-043-AMC-02536(E); Grant PL-89-358)
(NASA-CR-111389; TR-478) Avail: NTIS CSCL 09D

Cascading techniques in which the constituent codes are tree codes are studied. Determined is the efficiency attainable with cascading and the attainable error probability in terms of the composite decoding complexity. Major results in these areas are the following: (1) a two-stage cascaded tree code can be formulated to yield an error exponent that equals 1/2 of the single-stage error exponent at all rates below capacity; (2) if N is the composite decoding complexity per decoded symbol for a cascaded tree code in which maximum-likelihood decoding is applied to each constituent code it is possible to find, in the limit of asymptotically large N, a code for which the decoding error probability becomes arbitrarily close to (1/N) to the (C/R) power; (3) it is possible to use sequential decoding on the outer stage of a cascaded tree code and yet communicate at a composite rate exceeding R sub comp, provided that the alphabet sizes of the constituent codes are suitably restricted. Also shown is how to apply the Viterbi decoding algorithm to an unterminated tree code, and to describe the burst characteristics of decoding errors made by a Viterbi decoder. Author

N71-11271*# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.

RF PARAMETER STUDY IN SUPPORT OF STRUCTURES FOR ORBITING RADIO TELESCOPES (SORT) Final Report, 28 Jan. – 28 Oct. 1970

Stephen N. Andre, Richard J. Blum, and John O. Clark Oct. 1970 158 p refs
(Contract NAS5-21134)
(NASA-CR-111390; CAL-UM-2929-E-1) Avail: NTIS CSCL 09E

Studied are RF parameters of an orbiting 100-meter-diameter flight test model of a Low Frequency Radio Telescope (LOFT) operating in the 15- to 150-MHz frequency band. The study included investigations of dual-polarized antenna feeds and the characteristics of the reflector grid. A tradeoff study to establish design parameters of the LOFT antenna was also performed. Computer programs were developed to investigate effects of both axisymmetric and phi-dependent reflector surface errors on the far-field radiation patterns. The trapezoidal tooth antenna feed is recommended for the LOFT antenna application as a result of the feed study. The investigation of reflector grids resulted in a characteristic curve of grid performance versus grid mass. Far-field antenna patterns at and near the mainlobe were determined by a surface current integral formulation. In the angular region far from the mainlobe and in the shadow region behind the reflector, Geometrical Diffraction Theory was used to determine the radiation characteristics of the reflector. The tradeoff study to establish LOFT design parameters resulted in a recommended design. The LOFT performance characteristics for the selected design are also included. Author

N71-11272# Weapons Research Establishment, Salisbury (Australia).

REPORT OF TESTS CARRIED OUT ON THE AREA 6 MK. 3 LOX SYSTEM AT WOOMERA IN MAY 1969 TO EVALUATE A PROCEDURE FOR CORRECTLY OVERTOPPING THE EUROPA F9 VEHICLE

N. R. Sheppee and T. W. Miller Dec. 1969 42 p refs
(TN-DWD-27) Avail: NTIS

Earlier, tests were carried out on the Area 6 LOX System in March 1969, to confirm that 'auto-topping' and 'final-trim' could be successfully carried out using low storage tank pressures. The major conclusion of these tests was that with low site tank pressures, the equipment and methods used up to F7 would not permit long periods of 'auto-topping'. H.S.D. has proposed modifications and procedure amendments which will permit 'auto-topping' and 'final-trim'. The main purpose of this present Technical Note is to describe tests carried out during the 27 to 28 May, 1969 to prove that the new procedure is workable. At the same time additional tests were made to measure relevant flowrates and backpressures and to size the orifice. Author

N71-11273# Centre National d'Etudes des Telecommunications, Lannion (France).

MULTIPLE ACCESS SYSTEMS FOR THE TELEPHONIC USE OF COMMUNICATION SATELLITES [LES SYSTEMES D'ACCES MULTIPLE POUR L'EXPLOITATION EN TELEPHONIE DES SATELLITES DE TELECOMMUNICATIONS]

G. Payet Paris CNES 1970 10 p In FRENCH Presented at the Space Symp., Rennes, France, 16–19 Jun. 1970; sponsored jointly by CNES, Centre de Perfectionnement Tech., and Fac. des Sci. de Rennes
Avail: NTIS

The concept of satellite communication systems used for voice transmission and allowing multiple access is explained and the main methods of time division multiple access and frequency division multiple access are described. Economical and technical problems encountered in voice communications are discussed and a system based on assignment of circuits on request is presented. Future development of these techniques is discussed. ESRO

N71-11274# Centre National d'Etudes des Telecommunications, Lannion (France). Div. de Transmission et Espace.

THE WORLDWIDE COMMUNICATION SATELLITE NETWORK [LE RESEAU MONDIAL DE TELECOMMUNICATIONS PAR SATELLITES]

J. P. Housain 18 Jun. 1970 13 p In FRENCH Presented at the Space Symp., Rennes, France, 16–19 Jun. 1970; sponsored jointly by CNES, Centre de Perfectionnement Tech., and Fac. des Sci. de Rennes
Avail: NTIS

The build-up of the worldwide network of communication satellites is reviewed and the latest developments in satellite communications are described and future projects discussed. ESRO

N71-11275# Centre National d'Etudes Spatiales, Paris (France).

THE SYMPHONIE PROJECT [LE PROJET SYMPHONIE]

J. Bouvet 1970 15 p In FRENCH Presented at the Space Symp., Rennes, France, 16–19 Jun. 1970; sponsored jointly by CNES, Centre de Perfectionnement Tech., and Fac. des Sci. de Rennes
Avail: NTIS

The aims and the general characteristics of the Franco-German synchronous communication satellite project SYMPHONIE are presented. Besides cooperation between French and German industries, the technical characteristics of the onboard responder and the command system as well as problems linked with the launching of the satellite are also discussed. ESRO

N71-11276# Air Force Cambridge Research Labs., Bedford, Mass. Data Sciences Lab.

HELIUM SPEECH TRANSLATION USING HOMOMORPHIC TECHNIQUES

Roy F. Quick, Jr. (M.S. Thesis – MIT) 31 Jul. 1970 35 p refs
Its Phys. Sci. Res. Paper No. 425
(AD-712345; AFCRL-70-0424) Avail: NTIS CSCL 71/2

The application of advanced digital-processing techniques has great potential for systems that transmit voice or utilize information coded in the form of speech. The report employs a digital process that offers a new approach for general use in speech synthesis, and is an application of homomorphic methods to the problem of correcting the distorted speech of talkers in pressurized helium-oxygen atmospheres. The vocal-tract impulse response of such speech was extracted by the homomorphic deconvolution technique, and its frequency components were moved downward in frequency according to correction formulas given in a study by Gerstman (1966). Both linear and nonlinear frequency corrections were used. Speech samples taken at 800-foot pressure depth in a 96 percent helium, 4 percent oxygen atmosphere were processed in this way, using a digital simulation of Oppenheims (1969) analysis-synthesis system. Results indicate considerable promise for the technique as a tool for further study of helium speech, and perhaps as a future on-line translation method. Author (TAB)

N71-11277# Ohio State Univ. Research Foundation, Columbus.

APPLICATION OF COMMUNICATION THEORY AND RESEARCH TO THE EMERGENCY BROADCASTING SYSTEM. PRERECORDED PROGRAMMING Final Report, 1 Jul. 1969 – 31 Oct. 1970

Franklin H. Knower, Michael R. Johnson, and Thomas G. Johnson
Sep. 1970 128 p refs
(Contract DAHC20-69-C-0416)
(AD-712332) Avail: NTIS CSCL 17/2.1

A series of primary research contractors for the Office of Civil Defense were interviewed as background for an understanding of the problems of prerecording Emergency Broadcasting System messages to shelterees. Relevent research reports from these and other sources were reviewed. A broad spectrum of independent sources of human, social and communication behavior was also investigated. Findings from these sources were synthesized into a series of guidelines on procedures for communication applicable to E.B.S. Message systems. Strategies for the generation of needed message systems were formulated. Author

N71-11278 New Mexico State Univ., University Park.

AN FM CLICK MODEL FOR THE UNMODULATED CARRIER IN ADDITIVE NORMAL NOISE AND SOME STATISTICAL PROPERTIES OF THE CLICK EVENT

George Lynn Davis (Ph.D. Thesis) 1969 90 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 70-1232

The click event for the unmodulated carrier in a frequency modulation system is investigated on the basis of Rice's proposed model. A click model is developed which specifies the temporal characteristics of the event. The analysis is performed using the in-phase and quadrature components of the predetection noise process. Employing Rice's event conditioning requirements on these noise components, the conditional density of the mid-event phase rate given event occurrence is determined. In addition to specifying the density, the expected value and all higher order moments are shown to be nonexistent. The density and distribution are presented for the normalized phase rate. The click model is obtained by predicting the future states of the noise processes x(t) and y(t). Dissert. Abstr.

N71-11279# Technische Hogeschool, Eindhoven (Netherlands). Afdeling Elektrotechniek.

ON CONICAL HORN ANTENNAS

H. E. M. Koop, J. Dijk, and E. J. Maanders Feb. 1970 64 p refs
(TH-70-E-10) Avail: NTIS

A fundamental study of the near fields of a conical horn antenna is reported. The field components of the conical horn are deduced from Maxwell's equations. It appears that it is possible to approximate the aperture field of a finite conical horn antenna from the fields within an infinite conical horn. From the radiating antenna aperture, the fields outside the antenna can be computed and compared with the various measuring results. A clearer insight is obtained into the usual approximations which are related to the flare angle and the length of the horn. Author

N71-11280# Joint Publications Research Service, Washington, D.C.

DUAL-REFLECTOR ANTENNA FOR RADIO-RELAY COMMUNICATION

Yu. A. Yerukhimovich et al 5 Nov. 1970 20 p refs Transl. into ENGLISH from Antenny (Moscow), no. 7, 1970 p 3–21
(JPRS-51721) Avail: NTIS

Experimental results of a dual reflector antenna study with an offset focal axis are given and analyzed. It is shown that this antenna has high electrical parameters and may be recommended for use on radio relay communication lines. Author

N71-11281* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

MEANS FOR GENERATING A SYNC SIGNAL IN AN FM COMMUNICATION SYSTEM Patent

Frederick P. Landauer, inventor (to NASA) Issued 20 Oct. 1970 (Filed 21 Dec. 1967) 6 p Cl. 178-69.5; Int. Cl. H04n1/36; Int. Cl. H04l27/10 Sponsored by NASA
(NASA-Case-XNP-10830; US-Patent-3,535,451;
US-Patent-Appl-SN-692332) Avail: US Patent Office CSCL 17B

Circuitry for detecting synchronizing signals which are used to decipher and/or correlate received data is described. In this system a sync pulse is transmitted to a receiver in the form of signals in a first frequency band, followed by signals in a second frequency band. A sync indicating pulse is produced only when the two activating pulses occur in time coincidence. The circuit is relatively simple and greatly minimizes the effect of noise on the detection of sync signals. The system further recovers synchronizing signals transmitted as part of, and together with FM video information with low signal to noise ratio. Detailed descriptions accompany drawings of the diagrams. E.M.C.

N71-11282* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

FREQUENCY SHIFT KEYED DEMODULATOR Patent

Steven Teitelbaum and Charles Staloff, inventors (to NASA) Issued 17 Mar. 1970 (Filed 27 Nov. 1967) 6 p Cl. 329-104; Int. Cl. H03k7/06
(NASA-Case-XGS-02889; US-Patent-3,501,704;
US-Patent-Appl-SN-685748) Avail: US Patent Office CSCL 17B

A frequency shift keyed demodulator is described which is simple in construction, reliable in operation, and superior in noise rejectivity. The discriminator outputs are maintained separate and applied to two identical decoding channels, one for binary codes and the other for binary zeros. The two channels are identical and each includes a discriminator recitifier, a first gate responsive to the discriminator recitifier, a flip-flop, and a pair of gates for gating set and reset pulses to the flip-flop. Cross coupling from the flip-flop output of one channel to the set gate of the other channel prevents both channels from simultaneously producing outputs. Each channel includes a capacitor which must be charged each time a channel is activated. This capacitor causes the channel to ignore data modulated at greater than the desire rate. Furthermore, by a simple adjustment of the discriminator bias voltage, it is possible to vary the degree of frequency shift necessary to cause the discriminator to produce an output. Detailed descriptions accompany drawings of the device. E.M.C.

N71-11283*# National Aeronautics and Space Administration. Manned Space Flight Center, Houston, Tex.

MANNED SPACE FLIGHT NETWORK

Nov. 1970 10 p
(NASA-TM-X-66479) Avail: NTIS CSCL 17B

An overview is presented of the operational design of NASA's

Manned Space Flight Network. The role of each element of the network; 12 ground stations, one ship, and four jet aircraft, is discussed in terms of responsibility to the success of an Apollo flight. In addition, the basic operations of Mission Control Center and the network computers are briefly reviewed. D.L.G.

N71-11284* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
REENTRY COMMUNICATION BY MATERIAL ADDITION Patent
Clifford H. Nelson, inventor (to NASA) Issued 4 Oct. 1966 (Filed 19 Dec. 1963) 4 p Cl. 325-65
(NASA-Case-XLA-01552; US-Patent-3,277,375;
US-Patent-Appl-SN-332339) Avail: US Patent Office CSCL 17B

A method is described for accomplishing radio frequency communication through the plasma formed around a space vehicle as it enters or leaves a planetary atmosphere. The method consists of injecting a material into the flow field of the plasma to open a hole in the plasma layer through which radio frequency signals can be transmitted. The hole is produced by reducing the electron concentration of the plasma. The proposed material to be injected is water droplets and the apparatus to accomplish this involves a water supply, under pressure, connected on the outside surface of the vehicle to spray water into the layer of plasma. D.L.G.

N71-11285* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MULTI-FEED CONE CASSEGRAIN ANTENNA Patent
Charles T. Stelzried, Gerald S. Levy, and Masakazu Smoot Katow, inventors (to NASA) Issued 13 Oct. 1970 (Filed 9 Jul. 1968) 6 p Cl. 343-779; Int. Cl. H01q19/12, 19/14 Sponsored by NASA
(NASA-Case-NPO-10539; US-Patent-3,534,375;
US-Patent-Appl-SN-743429) Avail: US Patent Office CSCL 17B

A multi-feed cone Cassegrain antenna is described with a relatively simple arrangement for rapidly switching the antenna to operate with any one of the feed cones which are fixedly positioned with respect to a parabolic reflector. The antenna incorporates an asymmetrically truncated hyperbolic subreflector which is rotatable about the antenna's center axis to focus on the feed cone to be used. The configuration of the hyperbolic subreflector is such that one of its conjugate foci coincides with the parabola's focal point, while its other focus coincides with the phase center of the desired feed cone. In this way, feed cone changing is accomplished by rotating the hyperbolic subreflector from one feed cone to the other. D.L.G.

N71-11286*# New Mexico State Univ., Las Cruces. Communication Research Group.
ADVANCED STUDY OF VIDEO SIGNAL PROCESSING IN LOW SIGNAL TO NOISE ENVIRONMENTS Quarterly Progress Report, Oct. 1969 – Jan. 1970
Frank Carden, William Osborne, and Alton Gilbert Jan. 1970 14 p refs Submitted for publication
(Grant NGR-32-003-037)
(NASA-CR-108691) Avail: NTIS CSCL 17B

The required parameter values for acquisition and tracking of a carrier freqeuncy modulated by a single sinusoid are established for a second order loop. A three variable parameter space is examined consisting of the modulation index, the ratio of the modulation frequency to the loop natural frequency, and the normalized initial frequency offset. Conclusions are drawn from data accumulated through the use of a mathematical model. Simulation of the model on a digital computer was used to obtain numerical results. Verification of the numerical results was accomplished using a 455 KHz second order phase loop lock. Acquisition of the sidebands is discussed along with general comments on distortion. Author

N71-11287# Joint Publications Research Service, Washington, D.C.
COLOR AND STEREOSCOPIC TELEVISION
13 Nov. 1970 22 p refs Transl. into ENGLISH from Tekhn. Kino i Televideniya (Moscow), no. 9, Sep. 1970 p 52 – 57 and 62 – 65
(JPRS-51782) Avail: NTIS

CONTENTS:

1. CODER IN THE SECAM COLOR TELEVISION SYSTEM I. N. Denisenko et al p 1 – 12 refs (See N71-11288 02-07)
2. STEREOTELEVISION SYSTEM USING TIME PARALLAX P. V. Shmakov et al p 13 – 21 ref (See N71-11289 02-07)

N71-11288# Joint Publications Research Service, Washington, D.C.
CODER IN THE SECAM COLOR TELEVISION SYSTEM
I. N. Denisenko et al *In its* Color and Stereoscopic Television 13 Nov. 1970 p 1 – 12 refs (See N70-11287 02-07)
Avail: NTIS

A version of a coder design was selected in which all shaping of the special pulses necessary for operation of a coder generating signal in the SECAM color television system is done in the service signal unit coupled directly with the black-and-white sync generator. The shaped pulses and two standard quartz-stabilized subcarrier frequencies are carried over a cable network to the coders operating in the channels, in the mixer, and in the composite transmission unit. Author

N71-11289# Joint Publications Research Service, Washington, D.C.
STEREOTELEVISION SYSTEM USING TIME PARALLAX
P. V. Shmakov et al *In its* Color and Stereoscopic Television 13 Nov. 1970 p 13 – 21 ref (See N71-11287 02-07)
Avail: NTIS

The method described for obtaining stereotelevision pictures requires a frequency band of the communication channel smaller by one half than that of known stereotelevision systems. An advantage of the system is that the equipment for conventional two-dimensional television is used at the transmitting end and the standard communication channel is also preserved. The ground equipment becomes more complex in comparison with standard two-dimensional television equipment; equipment for delaying the video signal is added and the video monitoring device becomes more complex. Author

N71-11290*# North Carolina State Univ., Raleigh. Dept. of Electrical Engineering.
STUDY OF RECTANGULAR-GUIDE-LIKE STRUCTURES FOR MILLIMETER WAVE TRANSMISSION Progress Report, 1 Jun. – 30 Sep. 1970
Frederick J. Tischer 15 Oct. 1970 86 p refs
(Grant NGL-34-002-047)
(NASA-CR-111393) Avail: NTIS CSCL 17B

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1. INTRODUCTION TO GUIDE-LIKE STRUCTURE RESEARCH p 1 – 5 (See N71-11291 02-07)
2. COMPARATIVE STUDY OF FENCE GUIDE FIELDS p 6 – 32 (See N71-11292 02-07)
3. EXPERIMENTAL DETERMINATION OF THE Q-VALUES OF TWO FENCE GUIDE RESONATORS p 33 – 43 refs (See N71-11293 02-07)
4. DIELECTRICALLY LOADED PARALLEL-WALL GUIDE p 44 – 56 refs (See N71-11294 02-07)
5. EFFECTS OF SURFACE ROUGHNESS AT MILLIMETER WAVES p 57 – 64 refs (See N71-11295 02-07)
6. MEASUREMENTS ON MICROSTRIP LANES p 65 – 83 refs (See N71-11296 02-07)

N71-11291*# North Carolina State Univ., Raleigh. Dept. of Electrical Engineering.
INTRODUCTION [TO GUIDE-LIKE STRUCTURE RESEARCH]

In its Study of Rectangular-Guide-Like Struct. for Millimeter Wave Transmission 15 Oct. 1970 p 1–5 (See N71-11290 02-07)
Avail: NTIS CSCL 17B

Reported are comparative studies of field distributions in two prototypes of fence guides that differ only from each other by the spacing between wire grids forming the side walls. During these measurements, the effects of loading by the probe were studied and procedures were developed for reducing probe loading effects. The two sections of the fence guide were then used as resonators for the determination of Q-values in order to analyze waveguide attenuation. Study results on parallel-wall waveguides with various cross-sectional geometries and dielectric loading were used to obtain optimum geometries for H-guides and loaded fence guides. Measurements were also carried out on microstrip lines at millimeter frequencies. G.G.

N71-11292*# North Carolina State Univ., Raleigh. Dept. of Electrical Engineering.

COMPARATIVE STUDY OF FENCE GUIDE FIELDS

In its Study of Rectangular-Guide-Like Struct. for Millimeter Wave Transmission 15 Oct. 1970 p 6–32 (See N71-11290 02-07)
Avail: NTIS CSCL 17B

Measurements were carried out on two protopytes of fence guide with slightly different spacings between the posts of the wire grids forming the sidewalls. The field distributions inside and in the vicinity of the guide were determined. Their evaluation gives the values of the guide wavelength and of the decay factors for the exponential field decrease above and below the dielectric slab. Loading effects due to the probe were investigated and attempts made to correct the measured results and to eliminate errors due to loading. The loading effect of the probe was found to cause double peaks of the field distributions. A brief description of the loading and the compensation is included in the appendix. Author

N71-11293*# North Carolina State Univ., Raleigh. Dept. of Electrical Engineering.

EXPERIMENTAL DETERMINATION OF THE Q-VALUES OF TWO FENCE GUIDE RESONATORS

In its Study of Rectangular-Guide-Like Struct. for Millimeter Wave Transmission 15 Oct. 1970 p 33–43 refs (See N71-11290 02-07)
Avail: NTIS CSCL 17B

Two resonators using fence guides with different spacings of the posts of the wire grids were constructed and preliminary Q-measurements were carried out. The fence guide resonators were then loaded by inserting 1/32 in. thick Rexolite strips on top of the dielectric slabs between the wire grids. Further loading was obtained by adding a second strip of Rexolite. Increased Q-values were obtained by the loading. The measured Q-values were then used for the computation of the attenuation of the fence guide. Author

N71-11294*# North Carolina State Univ., Raleigh. Dept. of Electrical Engineering.

DIELECTRICALLY LOADED PARALLEL-WALL GUIDE

In its Study of Rectangular-Guide-Like Struct. for Millimeter Wave Transmission 15 Oct. 1970 p 44–56 refs (See N71-11290 02-07)
Avail: NTIS CSCL 17B

The characteristics of a parallel-wall waveguide loaded with dielectrics of three different geometries are experimentally investigated. Preliminary results of measurements of the longitudinal and transverse field distributions and their evaluation are presented. The field decrease towards the guide opening, the guide wavelength, and the Q-value of the waveguide are computed. The following dielectric structures were considered: (1) H-guide configuration - the dielectric strip perpendicular to the side walls; (2) dielectric strip parallel to the side walls; and (3) dielectric rod. Author

N71-11295*# North Carolina State Univ., Raleigh. Dept. of Electrical Engineering.

EFFECTS OF SURFACE ROUGHNESS AT MILLIMETER WAVES

In its Study of Rectangular-Guide-Like Struct. for Millimeter Wave Transmission 15 Oct. 1970 p 57–64 refs (See N71-11290 02-07)
Avail: NTIS CSCL 20N

Preliminary results of Q-value measurements for the study of the effects of surface roughness are given. The results indicate that the Q-value of resonators decreases with increasing roughness. Data are given which illustrate the effect. Author

N71-11296*# North Carolina State Univ., Raleigh. Dept. of Electrical Engineering.

MEASUREMENTS ON MICROSTRIP LANES

In its Study of Rectangular-Guide-Like Struct. for Millimeter Wave Transmission 15 Oct. 1970 p 65–83 refs (See N71-11290 02-07)
Avail: NTIS CSCL 17B

The propagation characteristics at millimeter wavelengths of microstrip transmission lines are discussed. The results of an experimental investigation of the properties of strip lines on alumina substrates in the frequency range of 31-35 GHz are reported. Author

N71-11297*# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.

A UNIFIED THEORY OF COHERENT DIGITAL SYSTEMS WHICH TRACK DOPPLER FREQUENCY Interim Technical Report

Charles L. Weber Oct. 1969 40 p refs
(NASA Order EW-473447; Grant DA-ARO(D)-31-124-G1045)
(NASA-CR-111388; USCEE-374) Avail: NTIS CSCL 17B

A unified theory from which the design of a large class of coherent digital communication systems can be optimally carried out is presented. In the design of digital communication systems, the error rate is the criterion which is invariable emphasized. In many digital systems, however, there is relative motion between transmitter and receiver which must be estimated by making use of Doppler frequency information. A new analysis of a general class of coherent digital systems is herein developed, in which the trade-offs that exist between Doppler measurement capability and sub-carrier demodulation error rate are quantitatively presented. The theoretically unrecoverable power loss which exists when employing frequency division multiplexing subcarriers as compared to time division multiplexing is described. The results point out that there is significant parametric dependence of the optimal choice of system parameters on the carrier loop signal-to-noise ratio and the data rate. Author (TAB)

N71-11298* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

BI-CARRIER DEMODULATOR WITH MODULATION Patent

James R. Currie, inventor (to NASA) Issued 29 Mar. 1966 (Filed 20 Sep. 1963) 6 p Cl. 340-198
(NASA-Case-XMF-01160; US-Patent-3,243,791; US-Patent-Appl-SN-310507) Avail: US Patent Office CSCL 17B

Systems which simultaneously demodulate two modulated alternating current signal carriers closely related in frequency are described. The demodulator eliminates filter requirements and is effective when the carriers vary in frequency absolutely and with respect to each other. A signal containing two modulated carriers is demodulated by one synchronous demodulator with a keying input of one of the carrier frequencies and by a second synchronous demodulator with a keying frequency of the other carrier. Prior to the demodulation the unwanted carrier is subtracted out. Two new modulated carriers are created to serve as appropriate subtrahends, and these carriers are separately created by taking an output of each of the demodulators and impressing it on a corresponding frequency carrier. The separate demodulator outputs are free of the other. N.E.N.

N71-11299*# TRW Systems Group, Redondo Beach, Calif. Communication and Sensor Systems Dept.

OPTIMUM PREEMPHASIS-DEEMPHASIS FILTER CHARACTERISTICS FOR LCRU TELEVISION

R. J. Pannelton 18 Sep. 1970 32 p refs
(Contract NAS9-8166)
(NASA-CR-108676; TRW-17618-H017-R0-00) Avail: NTIS CSCL 17B

The optimum preemphasis-deemphasis filter pair is derived for FM transmission of baseband video signals (or any baseband signal where the power spectrum is concentrated near the lower end of the band) such as the Lunar Communications Relay Unit color television signal. The optimum filter pair is designed to maximize the video output signal to noise ratio for a given average modulating signal power and thus improve the performance of the television system. The analysis is based upon an envelope model of the video power spectral density and an FM channel which has a constraint on maximum modulating signal power. It is further assumed that the signal to noise ratio on the channel is above FM threshold, and that the network first breakpoint frequency equals the video envelope −3 db frequency. Author

N71-11300* Lockheed Electronics Co., Houston, Tex.

TELEVISION SIGNAL SCAN RATE CONVERSION SYSTEM Patent

Phillip C. Lipoma and Howard E. Te Poel, inventors (to NASA) Issued 3 Feb. 1970 (Filed 23 Oct. 1968) 8 p Cl. 178-6.6; Int. Cl. H04n5/76 Sponsored by NASA
(NASA-Case-XMS-07168; US-Patent-3,493,677; US-Patent-Appl-SN-769788) Avail: US Patent Office CSCL 17B

A system is described to convert the slower scan rate of the TV camera used on the moon by the astronauts to the faster scan rate of commercial TV. The slow pictures are intermittently scanned by a standard television camera, whose signal is supplied to magnetic recorder and to the system output terminal. The magnetic recorder plays back the recorded signal between fast scans a sufficient number of times to fill the gap. These playback signals are supplied to the system output terminal providing a continuous fast scan type television. The system also converts the noninterlaced Apollo signals into interlaced television signals. N.E.N.

N71-11301*# Louisiana Polytechnic Inst., Ruston. Dept. of Electrical Engineering.

INVESTIGATION OF COMMUNICATION SYSTEMS FOR LUNAR USE

Horace Sammie Allen, III Aug. 1970 69 p refs
(Grant NGR-19-003-003)
(NASA-CR-108667) Avail: NTIS CSCL 17B

Communication techniques for lunar surface to lunar surface and for moon to earth communication are discussed. The severe problems are identified as lack of atmosphere making sky wave communication impossible and small lunar radius. The use of surface waves and the use of two antennas above the lunar terrain are investigated as solutions to the problems. An active repeater could be stationed so that an astronaut beyond the line-of-sight and the landing module would be in communication. A lunar telephone line between astronaut and LM is discussed, and calculations to demonstrate the capability of a subsurface link are included. A system of lunar polar satellites and earth relay is considered to be effective for missions greater than 280 miles, and lunar satellites would also add capability to CSM communication. The techniques are evaluated on the basis of equipment weight and development costs. N.E.N.

N71-11991*# Kansas Univ., Lawrence.

RADAR AND DATA PROCESSING

Richard K. Moore *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 2 1969 28 p refs (See N71-11976 02-13)
Avail: NTIS CSCL 17I

Progress is reported on radar and data processing research to determine the best design of space radars for earth resources application for different types of spacecraft, and to develop means for automatic processing of the large quantity of multi-image data from the radars and other sensing systems. The various possible spacecraft radars and tradeoffs involved between the various parameters are evaluated. To assist in understanding the empirically derived information from the aircraft measurements, a continuing study of the fundamentals of radar scattering from natural surfaces and simplified surface models is conducted. Analog and digital systems for processing multi-image data are discussed. R.B.

N71-12010# Naval Academy, Annapolis, Md. Dept. of Engineering.

THE IDENTIFICATION OF ARBITRARILY SHAPED TARGETS WITH THE SCATTERING MATRIX Interim Technical Report

Frank P. Kuhl and Albert J. Perrella Aug. 1970 29 p refs
(AD-712067; USNA-E-70-11) Avail: NTIS CSCL 17/9

It is well known that the shape of a conducting target can be classified according to information derived from polarized, radar backscatter formulated as the scattering matrix. It is shown that the important information about the shape of an arbitrary target is included in five invariant parameters, designated as A, B, C, X, and Y, which are derived from the scattering matrix, and that these parameters are functions of the target yaw and roll angles. As a target follows a particular path in yaw and roll angles, its trace in five-dimensional, A-B-C-X-Y space is developed, and the complete classification of a target for all aspects is a closed surface in A-B-C-X-Y space. An unknown target is identified by matching its trace for closeness with the known-classification surfaces. The classification and recognition system proposed in this paper makes use of multiple observations of the scattering matrix of the unknown target. Each observation yields a point (A, B, C, X, Y) that is then mapped in a uniformly spaced, five-dimensional grid to the closest grid intersection. The mapped points are connected and encoded with a vector train and a useful measure of closeness between two vector trains is shown. Author (TAB)

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N71-11302# Laboratoire d'Automatique et de ses Applications Spatiales, Toulouse (France).

CONTRIBUTION TO THE DIGITAL CONTROL OF A SYNCHROMACHINE [CONTRIBUTION A LA COMMANDE NUMERIQUE D'UNE SYNCHROMACHINE]

Claude Chicoix (Ph.D. Thesis — Toulouse Univ.) 1969 183 p refs In FRENCH Sponsored by Compagn. Intern. de l'Informatique
Avail: NTIS

The design of a real time device to command a synchromachine by a computer is described. The system is based on generating two variable voltages modulated by either the sine or the cosine of the binary input data. The generator has an accuracy better than 0.0001 and uses digital to analog converters with an accuracy of the same order of magnitude. ESRO

N71-11303 Newcastle Univ. (England). Computing Lab.

ON FILE STRUCTURING FOR NONUNIFORM ACCESS FREQUENCIES

E. G. Coffman and J. Bruno (Princeton Univ.) Jan. 1970 19 p refs
(TR-6) Copyright. Avail: Issuing Activity

An important property of file structures is their behavior when the underlying distribution of access frequencies is non-uniform.

Considered are methods for structuring files so that initially unknown but non-uniform access frequencies are exploited in a way that reduces mean search times. As a specific illustration a simple algorithm is applied to sequence search trees and shown to produce structures with mean search times that are significantly less than those produced by an algorithm creating tree structures independent of access frequencies. An analytic result is obtained for this improvement when access frequencies are uniform. Samples from the results of Monte Carlo simulations are used to illustrate this improvement when access frequencies are non-uniform. Author

N71-11304# National Bureau of Standards, Washington, D.C. Statistical Engineering Lab.

A SYSTEMS PROGRAMMER'S GUIDE FOR IMPLEMENTING OMNITAB 2

Sally T. Peavy, Ruth N. Varner, and Shirley G. Bremer Nov. 1970 47 p refs
(NBS-TN-550) Avail: SOD $0.50 Catalog No. C-13.46:550

OMNITAB II is a general-purpose program which permits direct use of a computer without prior knowledge of computer languages. This technical note provides assistance to the systems programmer, with the task of implementing OMNITAB II, by pointing out where difficulties may occur and how to cope with them. It furthermore outlines a method for segmenting the OMNITAB II system which is very large. It is a partial documentation of the omnitab program. Author

N71-11305# Ohio State Univ., Columbus. ElectroScience Lab.

A SYNTACTICAL ANALYSIS OF THE PATTERN DESCRIPTION LANGUAGE PADEL

John O. Amoss and Kenneth J. Breeding Jul. 1970 34 p refs
Supported in part by Bell Telephone Labs., Columbus, Ohio
(Grant AF-AFOSR-1710-69)
(AD-711406; AFOSR-70-2359TR; TR-2768-2) Avail: NTIS CSCL 9/2

The paper describes an artificial language called PADEL which may be used to describe line drawings. The language may be thought of as being a translational grammar in that picture elements correspond in a one to one way with the languages vocabulary. The picture elements of interest are first described. PADELs grammar is then formally defined followed by a description of the correspondence between picture elements and elements in the grammar. This grammar is then analyzed as an element of the set of phrase structured grammars. It is then shown that this grammar is a finite state or regular grammar. Finally a regular expression describing all possible strings in the language is derived. Author (TAB)

N71-11306# Center for Applied Linguistics, Washington, D.C. Language Information Network and Clearinghouse System.

SOME PROBABLE TECHNOLOGICAL TRENDS AND THEIR IMPACT ON AN INFORMATION NETWORK SYSTEM

Joseph L. Ebersole May 1970 16 p
(Grant NSF GN-771)
(PB-192494; LINCS-3-70) Avail: NTIS CSCL 05B

Improvements in the technology associated with the information sciences are discussed. Both machine and method improvements are presented. Machine includes computers, transmission services, communication terminals, photocomposition or other printing devices, input preparation devices, and facsimile or TV reproduction of images. Method refers to indexing, content representation, and file structure concepts and techniques. Author

N71-11307# Massachusetts Inst. of Tech., Cambridge.

COORDINATION OF ASYNCHRONOUS EVENTS

Suhas Shrikrishna Patil (Ph.D. Thesis) Jun. 1970 238 p refs
(Contract Nonr-4102(01); Proj. Mac)
(AD-711763; MAC-TR-72) Avail: NTIS CSCL 9/2

The way activity in a system proceeds is that events occur as a result of some conditions and lead to some new conditions which make other events possible. Often it is necessary to coordinate such events to ensure proper behavior. Coordination nets for representing such coordinations and physically realizable structues for enforcing such coordinations are presented. These structures are modular and can be mechanically derived from the coordination nets. Coordinations involved in concurrent management of resources are also discussed. Author (TAB)

N71-11308# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ELECTRONIC KEYBOARD CALCULATOR

K. G. Borisov et al 23 Jul. 1970 9 p refs Transl. into ENGLISH from Mekhaniz. i Avtomatiz. UPR. (USSR), no. 3, 1968 p 50–51
(AD-711755; FTD-MT-24-09-70) Avail: NTIS CSCL 9/2

The SKB Tochelektropribor developed a desk-type keyboard calculator for accounting purposes which can add, subtract and shift automatically, and multiply semiautomatically. The calculator comprises two registers, a digit switch, an adder, a shift unit, a control unit, an input unit, and a display. The registers are designed with pulse-position multistable elements based on a synchronized multivibrator. The adder contains a pulse-position decade which has a pulse-position-to-number-of-pulses converter at its input. An experimental model of the calculator comprises 1200 parts, among which are 150 transistors and 300 diodes; dimensions, 380 x 230 x 110 mm; weight, 7 kg; consumption, 15w. TAB

N71-11309# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ANALOG COMPUTER WITH CONSTANT DIAGNOSTIC MONITORING

G. S. Britov et al 17 Jul. 1970 7 p Transl. into ENGLISH from Russian Patent no. 231237 (Appl. no. 1164762126-24, 10 Jun. 1967) 2 p
(AD-711144; FTD-HT-23-323-70) Avail: NTIS CSCL 9/2

To increase reliability and reduce monitoring equipment, an analog computer is equipped with two monitoring devices, each of which consists of an integrator and two summators; the inputs of the integrator and one summator of each monitoring unit are connected, correspondingly, with the inputs and outputs of all working integration and summation units, while the outputs of these monitoring integrators and summators are connected with the inputs of the secondary monitoring summators across comparators, the number of which exceeds the number of the monitored units by two, either to the recording or signalling devices or to the automatic machine-stop circuit. Author (TAB)

N71-11310# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

A CASCADE SYNTHESIS OF BOOLEAN FUNCTIONS

Vaclav Dvorak 24 Jul. 1970 23 p refs Transl. into ENGLISH from Slaboproudy Obzor (Prague), v. 29, no. 6, 1968 p 333–339
(AD-711154; FTD-HT-23-339-70) Avail: NTIS CSCL 9/2

The development of integrated-circuit technology in recent years is the reason for a new method of treating the design of logic arrays, the so-called cellular technique. The article especially treats the cascade synthesis of logic functions, which forms the base of two-dimensional arrays as well. First of all the results of the functions of the synthesis by cascading cellules with one line and applying these cascades in two-dimensional arrays are surveyed. In more general two-line cascades there is first shown a method of synthesizing a single function, and then the authors new method of the simultaneous synthesis of a twin pair of functions with four variables. Furthermore a new arrangement of a twin line cascade controlled by a decoder is being suggested, which may be used for synthesizing functions of 4, 5 and even more variables. This cascade has a canonical shape and is therefore suitable for application in two-dimensional arrays. Finally cascades with several lines are being discussed, for which the suggested synthesis method may be used. Author (TAB)

N71-11311# Montana State Univ., Bozeman. Electronics Research Lab.
THE DESIGN OF A MATRIX-ORIENTED CELLULAR COMPUTER CAPABLE OF FAULT-TOLERANT OPERATION
Michael C. Mulder 15 Aug. 1970 335 p refs
(Contract N00014-67-C-0477)
(AD-711305; ERL-603-T3-0870) Avail: NTIS CSCL 9/2

The report describes the design of an array-structured cellular computer specially organized to efficiently implement matrix-oriented algorithms. In addition, this computer has general-purpose programmability and is capable of fault-tolerant operation; three fault-tolerant organizations are prsented. The execution speed of this computer is a factor of N squared (where N is the dimension of the array) or more faster than a sequential computer with the same clock period. This computer is useful in real-time applications where high-speed operation is required, but where flexibility and size requirements prevent the use of special-purpose or high-speed general-purpose computers, e.g., sample data control systems, vehicle navagation, phased radar control computations and sonar receiving array computations. Author (TAB)

N71-11312*# Stanford Univ., Calif. Digital Systems Lab.
A SURVEY OF MODELS FOR PARALLEL COMPUTING
T. H. Bredt Aug. 1970 64 p refs
(Grant NGR-05-020-337; Contract N00014-67-A-0112-0044)
(NASA-CR-111412; SU-STAN-CS-70-171; SU-SEL-70-044; TR-8)
Avail: NTIS CSCL 09B

The work on formal models for parallel computations and computer systems is reviewed. A general definition of a parallel schema is given so that the similarities and differences of the models can be discussed. Primary emphasis is on the control structures used to achieve parallel operation and on properties of the models such as determinacy and equivalence. Decidable and undecidable properties are summarized. Author

N71-11313*# Stanford Univ., Calif. Digital Systems Lab.
ANALYSIS OF PARALLEL SYSTEMS
T. H. Bredt Aug. 1970 60 p refs
(Grant NGR-05-020-337; Contract N00014-67-A-0112-0044)
(NASA-CR-111413; SU-STAN-CS-70-172; SU-SEL-70-057; TR-7)
Avail: NTIS CSCL 09B

A formal analysis procedure for parallel computer systems is presented. Each component to the system is described by a completely specified fundamental mode flow table. The concept of an output hazard is introduced to account for the effects of line delay and the lack of synchronization among components. Necessary and sufficient conditions for the absence of output hazards are given. The state of a parallel system is defined by the present internal state and input state of each component. The operation of the system is described by a system state graph which specifies all possible state transitions for a specified initial system state. A procedure for constructing the system state graph is given. Finally, the conditions of determinacy and output functionality, which have been used in other models of parallel computing, are discussed as they relate to correct solutions to the mutual exclusion problem. Author

N71-11314*# Martin Marietta Corp., Denver, Colo. Electronics Research Dept.
FORMULATION OF A TELEMETRY COMPUTER PROGRAM, SUPPLEMENT 1 Final Report
Keith H. Hill, Robert O. Leighou, and Duane L. Starner Sep. 1970 26 p refs
(Contract NAS8-24017)
(NASA-CR-102918; MCR-70-38-Suppl-1) Avail: NTIS CSCL 09B

The major advantages of this algorithm are that it is fast and that it does not require excessive storage capability. The speed and low storage requirement allows minimization of Boolean functions with a large number of variables such as 16. A 16 variable problem is too large to work manually and must be done a portion at a time using just a few of the variables. This is not a desirable method. As an example of the performance of the algorithm, a 12 variable problem with approximately 50 percent of the possible combinations used, took 21.1 seconds of CPU time on a CDC 6500 computer including compilation, assembly and load time. Less than 65 K words of storage were required. From test problems with 8 through 12 variables, a projected CPU time for a 16 variable problem is 22 minutes and the storage remains constant because the algorithm was originally set up for the 16 variable problem. This algorithm thus provides the capability for minimization of Boolean functions for large number of variables which were previously done poorly by manual methods and could not be done with a computer because of excessive time and storage requirements. Author

N71-11315 Northwestern Univ., Evanston, Ill.
THE UNIVERSAL LOGIC MODULES AND THEIR APPLICATION TO LOGIC NETWORK DESIGN
Calvin Kuo-lee Tang (Ph.D. Thesis) 1969 102 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 70-169

A universal logic circuit (ULC) of a specified number of variables is a circuit that can be used to implement any logic function of up to that number of variables by simply varying its input/output terminal connections. When a ULC is fabricated in an integrated circuit package, it becomes a universal logic module (ULM). A kind of ULM's called the tree type ULM's (T-ULM's) is derived and discussed in detail. Various effects, such as the number of pins, the number of logic gates, and the number of logic levels on the design of the modules are considered. A modular realization technique which uses T-ULM's of a small number of variables as the building blocks to implement an arbitrary logic functions of various large numbers of variables in a tree structure is presented. A diagnostic procedure for locating all the faulty ULM's in a malfunctioning tree structure is given, and a method for improving the reliability of the tree structure using an error-correcting code is demonstrated. Dissert. Abstr.

N71-11316 Iowa Univ., Iowa City.
MODELING AND ANALYSIS OF A NETWORK OF COMPUTERS
Edward Knight Bowdon, Sr. (Ph.D. Thesis) 1969 97 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 69-21670

A geographically distributed network of computing centers, each consisting of a number of, typically, identical computers is discussed. Based on the essential characteristics of a center, a queueing theory model for a multiserver system with a finite length nonpreemptive priority queue is developed. Then under the assumptions of Poisson input and exponentially distributed processing times, this idealized mathematical model is used to investigate the steady state stochastic behavior of jobs in the center. The efficiency of computer utilization and the average waiting time for different priority classes is presented. Dissert. Abstr.

N71-11317*# Scientific Translation Service, Santa Barbara, Calif.
PROCESSING OF ACTINOMETRIC DATA BY THE "COSMOS-122" SATELLITE [OBRABOTKA AKTINOMETRICHESKIKH IZMERENII SPUTNIKA KOSMOS-122]
I. A. Chetverikov Washington NASA Nov. 1970 10 p refs Transl. into ENGLISH from Tr. Gidrometeorologicheskogo Nauch.-Issled. Tsentra SSSR (Leningrad), no. 20, 1968 p 47-50
(Contract NASw-2035)
(NASA-TT-F-13367) Avail: NTIS CSCL 09B

Different types of actinometric measurements, performed by the Cosmos-122 satellite, are listed. The theory of devising a computerized program, and the program itself, as employed to process actinometric data, collected by the Cosmos-122 satellite, are detailed. Specimen outputs in the form of charts and graphs are shown and described. Author

N71-11318 Northwestern Univ., Evanston.
ANALYSIS AND SYNTHESIS OF SELF REPAIR TECHNIQUES FOR DIGITAL COMPUTERS
Stephen Anthony Szygenda, Jr. (Ph.D. Thesis) 1969 204 p
Avail: Univ. Microfilms: HC $9.25/Microfilm $3.00 Order No. 70-168

Self repair techniques, which are applicable to coordinately accessed memory schemes, are presented. Many of the traditional logic functions are being taken over by the memory. This presents the most challenging problem in striving for computer reliability. Therefore, a complete analysis of different coordinately accessed memories is performed. This analysis indicates that a linear select memory contains desirable features for detection, isolation and correction of faults. Therefore, a linear select scheme using a switching array is adopted to limit the number of drivers needed. With techniques developed for the switching array, it is possible to insure that failures caused by solid single faults will be restricted to a single word of a logical memory module. A current summing device is used to detect these faults and assist in their isolation. Dissert. Abstr.

N71-11319*# Stanford Univ., Calif. Digital Systems Lab.
THE MUTUAL EXCLUSION PROBLEM
T. H. Bredt Aug. 1970 71 p refs
(Grant NGR-05-020-337; Contract N00014-67-A-0112-0044)
(NASA-CR-111401; SU-STAN-CS-70-173; SU-SEL-70-058; TR-9)
Avail: NTIS CSCL 09B

How n components, which may be programs or circuits, in a computer system can be controlled so that (1) at most one component may perform a designated critical operation at any instant and (2) if one component wants to perform its critical operation, it is eventually allowed to do so, is discussed. This control problem is known as the mutual exclusion or interlock problem. A summary of the flow table model for computer systems is given. In this model, a control algorithm is represented by a flow table. The number of internal states in the control flow table is used as a measure of the complexity of control algorithms. A lower bound of n + 1 internal states is shown to be necessary if the mutual exclusion problem is to be solved. Author

N71-11320# RAND Corp., Santa Monica, Calif.
SOVIET CYBERNETICS REVIEW, VOLUME 4, No. 7
Wade B. Holland, ed. Jul. 1970 52 p refs
(Contract F44620-67-C-0045; Proj. RAND)
(AD-711361; RM-6200/7-PR-Vol-4) Avail: NTIS CSCL 9/2

The Ukraine figures prominently in three articles in this issue. The first is based on the 1969 Annual Meeting of the Ukrainian SSR Academy, at which the subject of economic cybernetics was discussed. The work of the Academys various economic institutes is outlined, summarizing some of the highlights of research in mathematical economics and control systems. The second article on the Ukraine discusses achievements and problems of computer systems in the Republic, particularly industrial applications for process control. The final article is a popularized description of the automatic computer design system developed at the Kiev Institute of Cybernetics. Also featured are photographs and description of the Ruta-110D, the first Soviet disc memory unit on display in Moscow at the Exhibition of National Economic Achievements. Their articles on computer activity analyze the dispute that is currently raging in Polish technical circles and on the system of computer centers in Romania. Author (TAB)

N71-11321# System Development Corp., Santa Monica, Calif.
INTRODUCTION TO SPACE PROGRAMMING LANGUAGE: OVERVIEW OF SPL, APRIL – SEPTEMBER 1970
11 Sep. 1970 11 p refs
(Contract F04701-70-C-0214)
(AD-711786; SAMSO-TR-70-326) Avail: NTIS CSCL 9/2

The report presents a historical overview of the evolution of the Space Programming Language (SPL) whose development was sponsored by the Space and Missile Systems Organization (SAMSO) of the Air Force and was performed by System Development Corporation. The events range from the Spaceborne Software Systems Study, begun in September 1965, to the current development of SPL compilers and an SPL Implementation Tool (SPLIT). The intent of SPLIT is to enhance the cost effective development of SPL compilers, reducing both production time and costs. The significant SPL milestones are presented in tabular form as well as graphically, correlating the milestones with the appropriate contract activity. Author (TAB)

N71-11322# System Development Corp., Santa Monica, Calif.
INTRODUCTION TO SPACE PROGRAMMING LANGUAGE: DEVELOPMENT OF SPL, APRIL – SEPTEMBER 1970
11 Sept. 1970 25 p refs
(Contract F04701-70-C-0214)
(AD-711789; SAMSO-TR-70-325) Avail: NTIS CSCL 9/2

The Space and Missile Systems Organization of the Air Force directed System Development Corporation in December 1967 to develop the Space Programming Language. The intent of the report is to define the language subsets, to briefly describe the form of the language, and to describe the highlights of the language. Discussed are the features which facilitate aerospace computations; minimize size of source programs; optimize object program execution time and object code size; provide real-time control, machine access, input and output, and debugging; and promote transferability. The reasons SPL was developed and the implementation of the language are described in separate brochures. Author (TAB)

N71-11323# Planning Research Corp., McLean, Va.
ATOMATIC DATA PROCESSING RESOURCE ESTIMATING PROCEDURES (ADPREP) Final Report
Silvio Pelosi, Bill Parham, John Barterman, Arlen Feldman Aug. 1970 110 p refs
(Contract DAHC15-69-C-0343)
(AD-711117; PRC-R-1527) Avail: NTIS CSCL 9/2

The objectives of the project were to determine the feasibility of collecting US Army experience data relative to the development, operation, and maintenance of computer application programs; and having done so, to collect and analyze data for developing extimating relationships. The projects report is organized in four volumes. The first volume summarizes the history of the project, presents the findings, conclusions and recommendations, and describes the results and methodology. The other three volumes contain the systems descriptions, the resource estimating procedures and the data collection plan. Author (TAB)

N71-11324# Electronic Systems Div., Bedford, Mass.
USER'S MANUAL. JOVIAL COMPILER VALIDATION SYSTEM (JCVS) Report For Mar. 1968 – Feb. 1969
Jul. 1970 234 p
(AD-711370; ESD-TR-70-278) Avail: NTIS CSCL 9/2

The report consists of detailed specifications for the use of the JOVIAL Compiler Validation System (JCVS). The system is designed to measure the compliance of a specific JOVIAL J3 compiler against the language specifications in Air Force Manual 100-24, Standard Computer Programming Language for Air Force

Command and Control Systems. The report describes the card input formats, deck structures, tape requirements, test modules, and operator procedures required to use the system. Author (TAB)

N71-11325# System Development Corp., Santa Monica, Calif.
INTRODUCTION TO SPACE PROGRAMMING LANGUAGE: IMPLEMENTATION OF SPL, APRIL – SEPTEMBER 1970
11 Sep. 1970 12 p refs
(Contract F04701-70-C-0214)
(AD-711787; SAMSO-TR-70-324) Avail: NTIS CSCL 9/2

The Space and Missile Systems Organization of the Air Force directed System Development Corporation to implement the SPL language by producing a compiler. The SPL compiler was built utilizing a syntax-directed compiler building technique. This compiler translates SPL source statements into machine or assembly language code. Two SPL compilers have been built to operate on the IBM 360 and to generate code for the IBM 360 and UNIVAC 1824 computers. Future compilers will be developed to operate on the CDC 6600 and to generate code for the IBM 360, CDC 6600 and UNIVAC 1824. Mark II and IV language subsets are being implemented. Author (TAB)

N71-11326*# Philco-Ford Corp., Houston, Tex. WDL Div.
PROGRAM REQUIREMENTS FOR THE DRAFT 2 SYSTEM, REVISION A
R. L. Runnels and J. Carlos Alvarez 25 Sep. 1970 132 p refs Revised
(Contract NAS9-1261)
(NASA-CR-108662; PHO-TR-409-Rev-A) Avail: NTIS CSCL 09B

The DRAFT system consists of a computer-driven digital display system, two operator consoles, a high-speed computer, a console to computer interface, a TV monitor hardcopy device, and the associated DRAFT software. Each console contains two display monitors, a pointer device, a typewriter and function keyboard, and an auxiliary function panel. The material presented outlines the operational environment of the system, its work flow, and its end items. Descriptions are given for the hardware through which the operator interacts with the system software, and the type of information entered and stored by the operators. The operators actions and required computer program responses are also detailed. Additions and changes to the original version of the system are included. Author

N71-11327# Boeing Scientific Research Labs., Seattle, Wash. Mathematical and Information Sciences Lab.
THE USE OF CIRCUIT CODES IN ANALOG-TO-DIGITAL CONVERSION
Victor Klee (Washington Univ., Seattle) Jul. 1970 16 p refs
(Contract N00014-67A-0103-003)
(AD-711944; D1-82-0950; Rept-22) Avail: NTIS CSCL 9/2

A d-dimensional Gray code (or, equivalently, a d-dimensional circuit code of spread 1 and length 2 to the d) is a Hamiltonian circuit in the graph I(d) of a d-dimensional cube. Such codes are commonly used to minimize the inevitable quantization error in the analog-to-digital conversion of serial data, and they are also used in the design of counters for purely digital systems. By using circuit codes of spread greater than 1, additional error-checking features can be introduced. A basic and difficult problem has been that of determining, for each d and s, the maximum length of d-dimensional circuit codes of spread s. The report contains an exposition of the known partial results on that problem, along with some suggestions for further research. Author (TAB)

N71-11328# System Development Corp., Santa Monica, Calif.
INTRODUCTION TO SPACE PROGRAMMING LANGUAGE: CONCEPTION OF SPL, APRIL – SEPTEMBER 1970
11 Sep. 1970 14 p refs
(Contract F04701-70-C-0214)
(AD-711788; SAMSO-TR-70-327) Avail: NTIS CSCL 9/2

The Space and Missile Systems Organization (SAMSO) of the Air Force sponsored a study performed by System Development Corporation regarding spaceborne software systems. After extensive analysis of these systems, three primary problems in the software development were found to be: short lead time, communication, and quality assurance. To aid in the resolution of these production problems, a higher-order language which was common to all phases of the production cycle, was recommended as a programming tool. Since no existing language met the space requirements for numerical computation, real-time control, limited storage capacity, and a close integration of assembly language and higher-order language, a new language known as the Space Programming Language (SPL) was developed. The report summarizes the language investigation portion of the Spaceborne Software Systems Study explaining the need for SPL, and the language specification activity. Author (TAB)

N71-11329# Naval Postgraduate School, Monterey, Calif.
A GENERAL FORTRAN COMPUTER PROGRAM FOR USE WITH THE IBM 2250 DISPLAY UNIT
Harlan Langtry Morrison (M.S. Thesis) Apr. 1970 61 p refs
(AD-711009) Avail: NTIS CSCL 9/2

A General computer program was designed, using the FORTRAN IV language, to utilize the IBM 2250 Display Unit in conjunction with the IBM System/360 Operating System. The user may adapt an associated program so that it may be an integral part of this general program. The general program provides the user with the ability to display a static information array and an input data array. The user may insert input data, for his associated program, from on-line input devices or directly through the IBM 2250 alphameric keyboard and may change this data from the keyboard. The associated program may be executed repeatedly, subject to system time constraints, and both alphameric and graphical output data from the associated program may be displayed after each execution. Author (TAB)

N71-11330# Naval Weapons Lab., Dahlgren, Va. Warfare Analysis Dept.
SOME APPLICATIONS OF AN EXPERIMENTAL LANGUAGE FOR SYMBOLIC MATHEMATICS
Larry R. Diesen Jul. 1970 116 p refs
(AD-710746; NWL-TR-2296) Avail: NTIS CSCL 9/2

The paper investigates the utility of an experimental programming language, FLAP, when applied to some typical problems of the working mathematician and engineer. The investigation is conducted by writing programs in the language to solve the following three typical problems: (1) Transforming differential equations by means of a change in independent variables. (2) Obtaining Frobenius series solutions of ordinary linear, second order, differential equations with polynomial coefficients about regular and regular singular points. (3) Obtaining a prime factorization of a polynomial in one variable with integral coefficients. Author (TAB)

N71-11331# Massachusetts Inst. of Tech., Cambridge. Dept. of Electrical Engineering.
HIERARCHIAL ASSOCIATIVE MEMORIES FOR PARALLEL COMPUTATION
Jeffrey Lee Gertz (Ph.D. Thesis) Jun. 1970 316 p refs
(Contract Nonr-4102(01); Proj. Mac)
(AD-711091; MAC-TR-69) Avail: NTIS CSCL 9/2

Two current trends in computing, namely the increasing importance of parallelism in computer operations and the concept of programming generality, indicate that new computer systems must employ location-independent addressing. One possible manner of accomplishing this objective involves the use of an associative memory for the computer system. The report is concerned with the study, analysis, and design of a multi-level associative memory for a highly parallel computer system, as well as the representation and execution of highly parallel programs in such a memory hierarchy. Author (TAB)

N71-11332# Montana State Coll., Bozeman. Electronics Research Lab.

A PARALLEL BCH DECODER

Ben A. Laws, Jr. 15 Jun. 1970 223 p refs
(Contract N00014-67-C-0477)
(AD-711306; ERL-603-T2-0670) Avail: NTIS CSCL 9/4

The subject of this technical report is the detailed design of a special purpose digital computer to decode the BCH codes. Report content may be summarized as follows. A review of the BCH decoding algorithms and decoders is made, including the applicable microcellular and macrocellular techniques. The BCH decoding algorithms are discussed and organized for execution by a parallel processor. All algorithms are implemented as APL programs to verify their operation. A detailed design for a parallel processor is described. Also included are discussions of fault detection and correction, operation for different code word lengths, an operation for different number of errors. The logic design of the parallel processor is simulated in detail by an assembly language program. Finally, a recommendation is made for further research in the areas of parallel processor and algorithm design. Author (TAB)

N71-11333*# Texas Univ., Austin.

RECOGNITION AND REPRESENTATION OF PARALLEL PROCESSABLE STREAMS IN COMPUTER PROGRAMS

1969 102 p
(Grant NGR-44-012-144)
(NASA-CR-109336) Avail: NTIS CSCL 09B

Techniques for detecting subtask parallelism in arithmetic expressions and detecting parallel processable segments within a single program are presented. Concepts of explicit and implicity parallelism are defined. The technique for detecting parallel processable segments is incorporated in the form of a FORTRAN recognizer program. This recognizer inputs a source program also in FORTRAN and outputs the parallel processable segments of the source program. Details, limitations, and overall flow charts of the recognizer are also given. In order for parallel processing to be effective, the overhead which accompanies this mode of operation must be minimized. In addition, it is felt that successful recognition of these streams at compilation time will minimize overhead during execution time. Author

N71-11334*# Astrodata, Inc., Anaheim, Calif.

TAPECLIP SYSTEM SPECIFICATION Final Report

R. G. Madsen 15 Mar. 1969 107 p refs
(Contract NAS2-4273)
(NASA-CR-73483) Avail: NTIS CSCL 09B

The established requirements for the design, fabrication, testing, delivery and installation of the NASA/ARC TAPECLIP System are detailed. The TAPECLIP system is a semi-automatic closed-loop ionogram processor operating from analog magnetic tape that will be used for processing sounder telemetry data from the topside sounder satellites. Author

N71-11335# R & D Consultants, Inc., Los Altos, Calif.

NONNUMERIC PROGRAMMING LANGUAGE STUDIES: ALTEXT 2 Final Report

James I. Dolby, Roger Stark (Lockheed and Space Co.), H. L. Resnikoff, and W. E. Houchin Arlington, Va. AFOSR Jun. 1970 159 p refs
(Contract F44620-69-C-0094)
(AD-711387; AFOSR-70-2315TR) Avail: NTIS CSCL 9/2

Computer languages for constructing algorithms for linquistic computation are not as far advanced as those for numeric computation, primarily because linguistics has not supported the same degree of algorithm development over the past four hundred years as mathematics has. As a result non-numeric languages must have an open-ended structure for use in each field of application. ALTEXT II is such a language--implemented as a set of assembly code macros that permit simple programming of most elementary problems in linguistic data processing and at the same time allows the development of special operators through the relatively simple expedient of adding new macros as they are needed. An examination of the statistical behavior of use of the operators corresponds to that found in natural languages for the distribution of the use of letters or phonemes, suggesting that the basic operators have been properly chosen. An elementary Users Guide to ALTEXT II and a Reference Manual for systems programmers are included as appendices to the report. Author (TAB)

N71-11336# Stanford Univ., Calif. Dept. of Computer Science.

EXAMPLES OF FORMAL SEMANTICS

Donald E. Knuth Jul. 1970 37 p refs
(Contract ARPA-SD-183)
(AD-711329; SU-CS-169; AI-Memo-126) Avail: NTIS CSCL 9/2

A technique of formal definition, based on relations between attributes associated with nonterminal symbols in a context-free grammar, is illustrated by several applications to simple yet typical problems. First the report defines the basic properties of lambda expressions, involving substitution and renaming of bound variables. Then a simple programming language is defined using several different points of view. The emphasis is on declarative rather than imperative or algorithmic forms of definition. Author (TAB)

N71-11337# Hawaii Univ., Honolulu. Dept. of Electrical Engineering.

ON MAJORITY-LOGIC DECODING FOR THE DUALS OF PRIMITIVE POLYNOMIAL CODES

Tadao Kasami and Shu Lin 20 May 1970 44 p refs
(Contract F19628-70-C-0082)
(AD-711791; SR-1; AFCRL-70-0325) Avail: NTIS CSCL 9/4

The class of polynomial codes introduced by Kasami et al. has considerable inherent algebraic and geometric structure. It has been shown that this class of codes and their dual codes contain many important classes of cyclic codes as subclasses, such as BCH codes, Reed-Solomon codes, generalized Reed-Muller codes, projective geometry codes and Euclidean geometry codes. The purpose of this paper is to investigate further properties of polynomial codes and their duals. First, majority-logic decoding for the duals of certain primitive polynomial codes are considered. Two methods of forming orthogonal parity-check sums are presented. Second, the maximality of Euclidean geometry codes is proved. The necessary and sufficient condition for the roots of the generator polynomial of an Euclidean geometry code is derived. Author (TAB)

N71-11338# Naval Postgraduate School, Monterey, Calif.

MEASUREMENT, ANALYSIS, AND SIMULATION OF COMPUTER CENTER OPERATIONS

William Leo Moll (M.S. Thesis) Jun. 1970 136 p refs
(AD-711293) Avail: NITS CSCL 9/2

The relatively new field of computer system measurement is reviewed. Several modern measurement products, both hardware and software oriented, are discussed. The batch processing operation of the W. R. Church Computer Centers IBM 360/67 was measured, analyzed, and simulated. A modern software monitor was used to measure computer system performance. User job characteristics were measured using built-in facilities of the computer operating system. Analysis of measurements taken led to experiments which resulted in improved system throughout. A dynamic simulation model of the Centers production service was developed to aid management in studying the effects of changes to the Centers operating policies. The model, although developed for a specific system, OS/360 (MVT Option), is applicable to modern multiprogramming operating systems in general. Author (TAB)

N71-11339# Colorado Univ., Boulder.
FACILITIES AND INSTALLATION SUPPORT Final Report, 1 Sep. 1969 – 31 May 1970
Philip E. Norgren May 1970 13 p
(Contract DADA17-69-G-9300)
(AD-711065) Avail NTIS CSCL 9/2

The report covers work done in implementing the hardware design described in the masters thesis A Time Shared Computing Facility Based on the Librascope L-3055 Data Processing System: The basic logic design has been implemented using commercial IC logic. Interface level shifters have been constructed using a combination of ICs and discrete components. Cabling has been installed in the central processing unit (CPU) of the L-3055 to connect the time sharing hardware to the system. Preliminary testing has been performed with the time sharing hardware connected to the CPU. The results of these tests indicate that some changes in logic will be required to complete the construction and obtain satisfactory performance. Author (TAB)

N71-11340# Massachusetts Inst. of Tech., Cambridge. Dept. of Electrical Engineering.
GENERALIZED ORGANIZATION OF LARGE DATA-BASES
Andrew Irwin Fillat and Leslie Alan Kraning (M.S. Thesis) Jun. 1970 249 p refs Sponsored by ARPA
(Contract N00014-69-A-0276-0002)
(AD-711060: MAC-TR-70) Avail: NTIS CSCL 9/2

Problems inherent in representation and manipulation of large data-bases are discussed. Data management is considered as the manipulation of relationships among elements of a data-base. A detailed analogy introduces concepts embodied in a data management system. Set theory is used to describe a model for data-bases, and operations suitable for manipulation of relations are defined. The architecture chosen for an implementation of the model is illustrated, and a representation of data-bases is suggested. A particular implementation, the GOLD STAR system, is investigated and evaluated. The framework outlined is meant to provide an environment in which complex data handling problems can be solved with relative ease. GOLD STAR provides the user with tools sufficient for manipulation of arbitrarily complex data-bases; these provisions are presented in the form of an extremely simple interface. Author (TAB)

N71-11341# Brown Univ., Providence, R.I. Div. of Applied Mathematics.
IMPULSE RESPONSE IDENTIFICATION FROM TRUNCATED INPUT DATA USING FFT TECHNIQUES
H. F. Silverman and E. A. Pearson Aug. 1970 28 p refs
(Grants AF-AFOSR-0693-67; NSF GK-2788)
(AD-710650; AFOSR-70-2229TR) Avail: NTIS CSCL 9/4

A method is presented for the noise-free identification of the kernel function of a finite memory linear system from normal operating input-output data. The problem is formulated taking into account the error in the output data which results from the truncation of the input to a finite time interval. Iteration in the frequency domain is used to overcome the truncation error, and a simple bound involving the input data is derived which is useful in predicting convergence. The Fast Fourier Transform algorithm is employed at each stage in the iteration which results in a computationally efficient identification procedure. Computer simulation studies of the algorithm are summarized which substantiate the theory and provide additional information of a practical nature. Author (TAB)

N71-11983*# Purdue Univ., Lafayette, Ind. Lab. for Agricultural Remote Sensing.
AUTOMATIC PROCESSING OF EARTH RESOURCE DATA
D. A. Landgrebe *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 2 1969 32 p
(See N71-11976 02-13)
Avail: NTIS CSCL 09B

The research of the Laboratory for Agricultural Remote Sensing (LARS), established to develop knowledge and techniques necessary to design an earth resource system utilizing aerospace platforms, is discussed. Studies are conducted in instrumentation and measurement, data processing, basic studies regarding the nature of earth surface materials, and consideration of user requirements for information generated by such a system. Progress in data processing studies is broken down into six segments: (1) improvements in LARSYS, the LARS programming system, (2) initiation of a system parameter sensitivity study, (3) the digital image display system, (4) data registration, (5) a new data classification scheme, and (6) a boundary-finding algorithm for multispectral data. Author

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N71-11342# Army Missile Command, Redstone Arsenal, Ala. Engineering and Quality Assurance Div.
CHARACTERISTIC IMPEDANCE MEASUREMENT IN ELECTRONIC TRANSFORMERS
John A. Koski 29 Jun. 1970 19 p refs
(AD-711895) Avail: NTIS CSCL 9/1

A method for measuring the characteristic impedance of wide-band and pulse transformers is derived from the second order high frequency model of the transformer. This model is used to predict the output time responses for various loading conditions. The characteristic impedance is calculated by relating the observed responses of the transformer, under corresponding loading conditions, to parameters of the equations derived from the model. Author (TAB)

N71-11343# ITT Electron Tube Div., Fort Wayne, Ind.
PATTERN THRESHOLD RECOGNITION DEVICE Quarterly Report, 1 Jan. – 31 Mar. 1970
Roger W. Hunter and L. G. Wolfgang Aug. 1970 78 p refs
(Contract DAAB07-69-C-0471)
(AD-712324; ECOM-0471-3; QR-3) Avail: NTIS CSCL 9/1

The objective of the contract is to develop a camera-tube utilizing an electro-statically focused image-tube input section, a flood gun for cancelling out ambient information, a storage-target capable of going over the first cross-over only when the threshold set by the flood-gun is exceeded, and an all electrostatic vidicon-type gun which will be used to scan the reverse side of the storage-target and generates an output signal only at discrete points on the storage-target whose potential exceeds the first crossover potential. Author (TAB)

N71-11344# Ion Physics Corp., Burlington, Mass.
HIGH VOLTAGE BREAKDOWN STUDY Final Report, 16 Nov. 1964 – 15 Nov. 1969
Michael J. Mulcahy, Philip C. Bolin, William R. Bell, A. S. Denholm, and F. J. McCoy Jun. 1970 252 p refs
(Contract DA-28-043-AMC-00394(E); ARPA Order 517)
(AD-711558; ECOM-00394) Avail: NTIS CSCL 9/1

There is a need for very high voltage vacuum tubes for certain high power radar systems. Unfortunately, serious problems are experienced in operating tubes reliably at the required voltage, which can be as high as 300 kV or more. For example, klystrons of the modulated anode type, where direct voltage has to be supported, are particularly prone to breakdown within the vacuum envelope. There seems to be little information on the precise nature of the problem. This is partly because usual method of packaging high power tubes and the radiation they produce makes difficult the visual observation of the discharge. Deductions about the problem appear to be essentially of the post mortem nature; i.e., from breakdown damage. However, it is clear that both vacuum gap breakdown and internal insulator flashover can occur. The program has been directed to the study and solution of the problem of breakdown within high power tubes to 300 kV. During the course of the study, visits to and discussions with tube manufacturers have confirmed the complexity and practical consequences of the problem of vacuum gap breakdown and insulator flashover and puncture. Author (TAB)

N71-11345# Hughes Aircraft Co., Torrance, Calif. Electron Dynamics Div.

SPECIAL DISTORTION AND ENVIRONMENTAL TESTS CONDUCTED ON THE HUGHES MODEL 745H TWT Final Report, 6 Oct. 1969 – 10 Jun. 1970

R. H. LeBorgne 10 Jun. 1970 176 p
(Contract N00039-70-C-2517)
(AD-711362; W-3290) Avail: NTIS CSCL 9/1

The report describes the results of a program to evaluate in detail the Hughes model 745H traveling-wave tube. The 745H TWT was developed for use in satellite communication systems and provides 1.3 kWs of power across the military band from 7.9 to 8.4 GHz. This tube utilizes the coupled-cavity slow-wave circuit which possesses a high interaction impedance to assure good efficiency over the operating band. In addition, it is mechanically and thermally rugged. Areas of investigation included a series of special distortion measurements on a government-furnished 745H. Subsequent and potentially more damaging environmental tests were performed on a new tube specifically fabricated for this program. In a continued effort to improve the performance of the 745H, a few small circuit changes were incorporated with a significant improvement in performance being realized. This new tube was subjected to the full requirements of MIL-E-16400 without failure. Extensive AM and FM noise measurements were made under vibration. Finally, the tube was operated at full output power for a limited life test of 500 hours under vibration. Author (TAB)

N71-11346 Pennsylvania Univ., Philadelphia.

DESIGN OF DIAGNOSABLE CONTROL UNITS FOR SWITCHING SYSTEMS USING MODULAR INTEGRATED CIRCUITS

Wing Noon Toy (Ph.D. Thesis) 1969 183 p ref
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 69-21444

In existing electronic switching systems, a considerable amount of program and system time is devoted to maintenance. The objective of a self-checking machine is to reduce this overhead at the expense of increasing the amount of fault detection hardware. Such a machine will lend itself more readily to a multiprocessing mode of operation, the result being more throughput compared with the synchronous instep duplicated approach. The advent of large scale integration (LSI) has opened new dimensions in the design of electronic control circuitry. Major gains in system reliability and performance, together with large cost reductions, are possible with integrated circuits. Moreover, savings in size, weight, and power are attractive features. These attributes motivate the designer of a switching central processor to exploit all the advantages of LSI and to produce a self-checking machine. Dissert. Abstr.

N71-11347# Motorola, Inc., Scottsdale, Ariz. Government Electronics Div.

SURFACE WEDGE ELECTRO-ACOUSTIC TRANSDUCERS Final Report, 1 Jun. 1969 – 30 Jun. 1970

Fred S. Hickernell 30 Jun. 1970 80 p refs
(Contract N00014-69-C-0297)
(AD-711982) Avail: NTIS CSCL 9/1

Theoretical and experimental work was directed toward the development of wedge transducer techniques suitable for the generation of broadband surface acoustic Love waves in the frequency range from 100 MHz to 500 MHz. Theoretical studies characterized wedge transduction and Love wave propagation characteristics. Bonding agents were identified which provided strong coupling of bulk shear waves to acoustic surface waves. Fused quartz and zinc oxide wedge transducers were used to excite surface waves in the VHF region. The propagation properties of Rayleigh waves on free surfaces and Rayleigh and Love waves on layered surfaces were investigated. Love and Rayleigh waves were guided on substrates of silicon using etched SiO2 waveguide structures. Author (TAB)

N71-11348# Lincoln Lab., Mass. Inst. of Tech., Lexington.

A THEORY OF MULTIPLE MODES IN AVALANCHE DIODES

Henry Berger 9 Jun. 1970 29 p refs
(Contract AF 19(628)-5167)
(AD-711923; TN-1970-17; ESD-TR-70-177) Avail: NTIS CSCL 9/1

The report develops a multidimensional, dynamic analysis of solid state avalanche diodes. Well-established electromagnetic concepts are applied to a widely used model of the diode and reveal a discrete spectrum of new small-signal modes. The approach used enlarges the conventional perspective and has permitted the discovery that at least one of these new modes appears to possess a high power capability (associated with its two-terminal negative resistance) which has been partially realized experimentally. The lowest-order mode contains all the results of prior quasi-static, theories on the normal IMPATT mode, plus additional information which is used to delineate the range of validity of the quasi-static results. Formal discrepancies are uncovered between the usual quasi-static, one-dimensional result for diode impedance used in solid state studies and the dynamic multidimensional result for the normal IMPATT mode developed from microwave circuit theory. However, these discrepancies are numerically quite small except in certain narrow frequency bands. Author (TAB)

N71-11349# Energy Conversion Devices, Inc., Troy, Mich.

BULK SEMICONDUCTOR SWITCH Final Technical Report, Feb. 1969 – May 1970

Ken E. Van Landingham, G. Ross Fleming, and David L. Nelson
Griffiss AFB, N.Y. RADC Aug. 1970 136 p
(Contract F30602-69-C-0191)
(AD-712366; ECD-512; RADC-TR-70-146) Avail: NTIS CSCL 9/1

The objective of this program was to establish the feasibility of utilizing amorphous semiconductor switches as the control elements in an electroluminescent display panel. This was accomplished by constructing and demonstrating a matrix addressable, 16 x 16 element display composed of 256 individual OVEL circuits, each OVEL consisting of a discrete, bulk electrode Ovonic Threshold Switch (OTS), an EL lamp segment and an appropriate series resistance. The source of power for the OVELs was a square wave, ac supply. The package selected to house the OTSs was a rigid, tubular ceramic structure 0.070 inches in diameter and 0.090 inches in length. The switches and series resistors were mounted on 16 printed circuit boards which plugged directly onto the 16 x 16 element EL lamp fabricated on a glass substrate with NESA strip front electrodes and individual aluminum back electrodes to define the cells. In most cases performance equaled or exceeded contract specifications. The display exhibited certain limitations; namely, a narrow operational temperature range, line erase rather than random erase, and loading effects at high bit densities. Nevertheless, the realization of a fast, matrix addressable display with inherent memory and good brightness and contrast amply demonstrated the viability of the approach. Author (TAB)

N71-11350# General Electric Co., Owensboro, Ky. Tube Dept.
C-BAND AND X-BAND DUAL FUNCTION OSCILLATORS Final Report, 1 Jun. 1966 – 31 Mar. 1969
J. D. Campbell and J. B. Quirk Ft. Monmouth, N.J. ECOM Aug. 1970 106 p
(Contract DA-28-043-AMC-02340(E))
(AD-711560; ECOM-02340-F) Avail: NTIS CSCL 9/5

The purpose of the program is to develop two oscillators, one at C-band and one at X-band, which function sequentially as a transmitter and as a gated local oscillator in their respective bands. These oscillators should have the potential of low cost, design simplicity, and low power drain to meet the requirements of lightweight radar sets having a common transmitter and local oscillator stage. Author (TAB)

N71-11351# Joint Publications Research Service, Washington, D.C.
OPTIMIZATION OF BASIC ELECTRONIC CHARACTERISTICS OF HIGH-EFFICIENCY LOW-NOISE ANTENNAS
S. M. Verevkin et al 30 Oct. 1970 12 p ref Transl. into ENGLISH from Antenny (Moscow), no. 5, 1969 p 61–71
(JPRS-51675) Avail: NTIS

Theoretical and experimental investigations of the surface utilization factor and the scattering coefficient of parabolic mirror antennas as a function of the focal length of the mirror and the radiation pattern of the primary radiation element are presented. A series of quantitative data are reviewed, and the optimal values of the parameters, their criticality, and the practical realization possibility are estimated. Author

N71-11352# Oklahoma Univ. Research Inst., Norman.
AN INVESTIGATION OF RELIABLE, HIGH CURRENT FLUX PUMPS Interim Report, Oct. 1968 – Oct. 1969
Keith J. Carroll 29 Oct. 1969 27 p refs
(Contract DAAK02-69-C-0082)
(AD-711569; Rept-1680-1) Avail: NTIS CSCL 9/1

The document reports on a superconducting flux pump which was constructed and tested. The device consists of a small superconducting coil in parallel with a larger magnet, attached to the secondary of a transformer and immersed in a liquid helium bath. The flux pump has energized the magnet to the 20 ampere level, using a very simple power input. Experiments to increase the pumping speed and current levels are described. Author (TAB)

N71-11353# Aerospace Corp., El Segundo, Calif. Plasma Research Lab.
SINGLE AND MULTISLOT ANTENNAS IN AN INHOMOGENEOUS REENTRY PLASMA ENVIRONMENT Research Report, Jan. – Aug. 1970
Kurt E. Golden and Gordon E. Stewart 30 Aug. 1970 19 p refs
(Contract F04701-70-C-0059)
(AD-711647; TR-0059(6220-10)-3; SAMSO-TR-70-306) Avail: NTIS CSCL 9/5

A short, linear, slot array radiating through an inhomogeneous reentry boundary-layer plasma in analyzed for free, standing-wave-feed, and traveling-wave-feed aperture excitations. Calculations are presented for self- and mutual-admittance, aperture voltages, element pattern, and the resulting antenna gain for free space and typical low-altitude reentry plasma conditions for a sharp, slender, conical vehicle. Author (TAB)

N71-11354# Ion Physics Corp., Burlington, Mass.
HIGH VOLTAGE BREAKDOWN STUDY Addendum to Final Report, 15 Aug. – 15 Sep. 1969
Michael J. Mulcahy, Philip C. Bolin, William R. Bell, and Frank Y. Tse Fort Monmouth, N.J. ECOM Mar. 1970 19 p refs Addendum
(Contract DA-28-043-AMC-00394(E); ARPA Order 517)
(AD-711559; ECOM-00394-Add) Avail: NTIS CSCL 9/1

The work reported describes a five-year program to study high voltage breakdown in vacuum and the factors which influence it with particular application to problems encountered in the development of high power vacuum tubes which operate in the range 100 to 300 kV. Factorial and statistical design was used because it provided a powerful tool for the analysis of the results and enabled information to be derived from a minimum number of experiments on both the effects of the individual factors and on the degree of interaction among factors. The test apparatus was designed and fabricated - bakeable vacuum chamber with control and monitoring apparatus (voltage, current, radiation and pressure). Six major experiments were carried out: Preliminary, Pilot, Block of Eight, Block of Thirty-Two, Energy Conditioning and Barium Contamination Experiments. Factors studied included: Environmental Factors (residual gas, temperature, envelope, magnetic field, contamination, oxide films); Fields, Geometry and Area; Electrode Materials and Surface Properties; Electrical Circuitry, and Energy and Experimental Factors. The results are analyzed and discussed. Author (TAB)

N71-11355# Rensselaer Polytechnic Inst., Troy, N.Y. Div. of Electrophysics.
BULK SEMICONDUCTOR LIMITERS Final Report, 10 Feb. 1969 – 9 Feb. 1970
K. E. Mortenson, J. N. Park, A. L. Armstrong, P. E. Bakeman, R. J. Gutmann et al Ft. Monmouth, N.J. ECOM Aug. 1970 116 p refs
(Contract DAAB07-69-C-0186)
(AD-711577; ECOM-0186-F) Avail: NTIS CSCL 9/5

A single, silicon element, iris limiter component was developed for X and K-band operation. Typical limiters have provided good isolation (25 db) with small low level loss (0.5 dB) and good high power handling capability (20 KW at X-band and 10 KW at Ku-band). Numerous fabrication procedures and element structures were evaluated in order to obtain an optimal element. The use of shallow diffused contacts, a checkerboard configuration, and a thin (3 to 5 mils) dot-plane structure proved most desirable. Compensated GaAs elements were investigated. Multiple slit irises and filter techniques were investigated in order to achieve broader bandwidth operation. A three element filter comprised of one active limiter and two passive cavities doubled the 1 dB down bandwidth. Similar broadband performance was achieved with a double slit iris, with improved low level loss, but degraded limiting characteristics. Author (TAB)

N71-11356# Microwave Associates, Inc., Burlington, Mass.
STUDY OF CYCLOTRON AND SYNCHRONOUS WAVE DEVICES Final Report, 1 Jul. 1968 – 30 Jun. 1970
Richard J. Briggs and S. Francis Paik Sep. 1970 115 p refs
(Contract DAAB07-68-C-0398)
(AD-712323; ECOM-0398-F; Fr-5) Avail: NTIS CSCL 9/1

A theory of transverse-wave interactions using a realistic model of the beam suitable for high-power amplifiers is presented. The energy exchange mechanism in transverse-wave interactions is reviewed, and the energy spread induced in a beam with non-zero size and space charge by high-power transverse-wave interactions is calculated. Various choices of design parameters are considefed to show the basic design contraints in terms of the maximum efficiency attainable in high-power amplifiers. The power saturation characteristics of transverse-wave amplifiers are examined by analyzing the nonlinear behavior of transverse-wave interactions. Results of the analyses provide the theoretical basis for predicting capabilities and limitations of high-power, high-efficiency transverse-wave amplifiers. The purpose of the experimental study was to verify the validity and determine limitations of various theoretical design equations. Experimental results confirm the theoretical predictions, and thus provide added credence to the theoretical projection of the potential device capabilities. TAB

N71-11357# Air Force Cambridge Research Labs., Bedford, Mass. Microwave Physics Lab.

THE INFLUENCE OF SOLAR ILLUMINATION OF X-BAND ANTENNA VOLTAGE BREAKDOWN PHENOMENA

S. B. Herskovitz and F. A. Liegeois 27 Aug. 1970 42 p refs
Its Phys. Sci. Res. Papers No. 426
(AD-712023; AFCRL-70-0472) Avail: NTIS CSCL 9/5

Among the results noted from a supersonic flight of a Nike-Cajun Rocket were: (1) the suggestion of influence of solar illumination on the breakdown of an X-band slot antenna, and (2) the presence of anomalous high-altitude breakdown. To corroborate these findings, Air Force Cambridge Research Laboratories launched a second Nike-Cajun Rocket from Wallops Island, Virginia, on 2 October, 1967. A strong influence of solar radiation on both the breakdown probability and duration was confirmed. The anomalous high-altitude breakdown phenomenon was absent. This report presents a statistical analysis of the voltage breakdown results gathered from the second flight, and develops a possible explanation for the observed phenomena based upon local emission of photoelectrons under solar illumination. The expected yield of electrons is shown to be strongly dependent upon the surface work function due to selective filtering of sunlight by the ozone layer. Author (TAB)

N71-11358# National Bureau of Standards, Washington, D.C. Electronic Technology Div.

TABULATION OF PUBLISHED DATA ON ELECTRON DEVICES OF THE USSR THROUGH MARCH 1970

Charles P. Marsden Oct. 1970 125 p refs Revised Supersedes NBS-TN-441
(NBS-TN-526-Rev; NBS-TN-441) Avail: SOD $1.25 Catalog No. C13.46:526

A tabulation of published data on electron devices of the USSR is presented. Information on tubes, transistors, diodes, and other electron devices reported. To make the information more readily available, a system has been developed for automatically tabulating the data in handbook form. Author

N71-11359# Laboratoire d'Automatique et de ses Applications Spatiales, Toulouse (France).

PHYSICS OF MOST INTEGRATED CIRCUIT FAILURE: APPLICATION TO ANALOG GATES Final Report [ETUDE PHYSIQUE DE LA DEFAILLANCE DES CIRCUITS INTEGRES A MOST: APPLICATION AUX PORTES ANALOGIQUES Rapport Final]

K. Lemaire, H. Martinot, and P. Rossel 18 Apr. 1969 74 p refs In FRENCH
(Contract CNES-66-334)
(Publ-569) Avail: NTIS

Properties of MOS transistors are reviewed and the effects of time, temperature, and ionizing radiation on their characteristics and mechanism are analyzed. An integrated analog gate is described and the sensibility of output values to variations of the different parameters of the components are evaluated. The drift with time of the components is analyzed and its physical meaning explained. ESRO

N71-11360# Centre National d'Etudes Spatiales, Paris (France). Div. des Techniques Electroniques.

PRESENT STATE AND FUTURE OF THE CONCERTO PROGRAM [ETAT ACTUEL ET PERSPECTIVES DU PROGRAMME CONCERTO]

J. Girard and M. Gadoin 1970 30 p In FRENCH Presented at the Space Symp., Rennes, France, 16–19 Jun. 1970; sponsored jointly by CNES, Centre de Perfectionnement Tech., and Fac. des Sci. de Rennes
Avail: NTIS

The Concerto program, launched by CNES in connection with the SYMPHONIE project, is part of the French plan to aid industry in the development of the fabrication of high reliability electronic components. It covers some 15 fabrication ranges in both passive and active components. The extension of the program to the fabrication of cables, connectors, switches, and printed circuits is under consideration. After a brief description of the methods involved in this program the organization set up by CNES is given and results and future developments are discussed. ESRO

N71-11361*# General Electric Co., Schenectady, N.Y. Tube Dept.

ANALYTIC STUDY OF A DEPRESSED COLLECTOR FOR LINEAR BEAM MICROWAVE AMPLIFIERS Final Report

T. G. Mihran and W. Neugebauer 8 Jul. 1970 101 p refs
(Contract NAS3-11530)
(NASA-CR-72768) Avail: NTIS CSCL 09E

An analytic study was made of a wide variety of depressed collectors, utilizing magnetic fields, for use with klystrons and traveling-wave tubes. Final calculations were implemented by use of a pair of analog computers which permitted space charge to be considered in approximate form. An optimized collector, employing a tilted electric field and an axial magnetic field, was designed for use on a 12-GHz klystron. The calculated collector efficiency ranges from 65 to 80 percent depending upon electrode number. This collector should increase the power conversion efficiency of a tube from 50 to approximately 80 percent. Author

N71-11362# Danish Research Center for Applied Electronics, Copenhagen.

THICK FILM TECHNOLOGY: SCREEN PRINTING TECHNIQUE. PASTE RESISTANCE, CERAMICS FOR OPTIMAL FIRING PROCESSES [TYKFILMTEKNIK 1: TRYKKETEKNIK OG MASKER. MODSTANDSPASTA, KERAMIK OG OPTIMERING AF BRAENDEPROCES]

S. T. Olesen Mar. 1970 121 p refs In DANISH; ENGLISH summary
(ECR-12) Avail: NTIS

Described are fundamental processes and materials used in production of thick film circuits. The printing process is described and tests are carried out to determine the optimum working conditions such as viscosity of paste, hardness, speed, and pressure for squeegee, etc. Furthermore, problems in connection with the choice of screentype are treated and tests are carried out to determine line resolution and economy of paste. Paste rules for storage, preparation, and blending to a given resistance value are outlined, and a number of manufactured pastes are examined by test firings at a large range of temperatures and time. Permissible tolerances of firing time and temperature are determined in consideration of electrical parameters such as resistance per square, temperature coefficient, noise index, geometric factor, and stability. The report contains an examination of various substrates of the alumina type and measurements of their micro- and macrostructures. Author

N71-11363*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

COMPUTER-ACQUIRED PERFORMANCE MAP OF AN ETCHED-RHENIUM, NIOBIUM PLANAR DIODE

Richard B. Lancashire [1970] 6 p refs Presented at the 1970 Thermionic Conversion Specialists Conf., Miami, Fla., 26–29 Oct. 1970; sponsored by IEEE
(NASA-TM-X-52926) Avail: NTIS CSCL 09A

A fixed-space planar diode with a guarded collector was performance-mapped in a multi-station facility which is connected to a centralized computer data acquisition system. The etched-rhenium emitter was separated from the niobium collector by 10 mils. The use of the computer system allowed off-design as well as on-design conditions to be observed. Emitter temperatures from 1500 to 2050 K were tested. Collector temperatures were varied from 750 to 1180 K, and cesium reservoir temperatures were varied from 525 to 650 K. The data are presented on J, V and P, V plots. The collection of the current, voltage curves was achieved by sweeping the diodes over a period of approximately 10 milliseconds with a variable electronic load controlled by the central digital computer. Author

N71-11364# Laboratoire d'Automatique et de ses Applications Spatiales, Toulouse (France).

STUDY OF THE LOW FREQUENCY BACKGROUND NOISE IN PLANAR SILICON TRANSISTORS PARTICULARLY THE BURST NOISE PHENOMENON Final Report [ETUDE DU BRUIT DE FOND BASSE FREQUENCE DES TRANSISTORS PLANS AU SILICIUM ET PLUS PARTICULIEREMENT DU PHENOMENE DE "BRUITS EN CRENEAUX" Rapport Final]

G. Blasquez, J.-C. Martin, and J.-M. Ribeyrol 8 Jul. 1969 111 p refs In FRENCH

(Publ-586) Avail: NTIS

Low frequency background noise in planar silicon transistors is analyzed and two types of noise are considered: (a) l/f noise for which a measuring device is designed leading to the definition of an equivalent circuit. The model designed is applied to metal oxide transistors and to tetrode transistors, and (b) burst noise. The form and the probability of the bursts and the effect on bursts of electrical parameters are discussed and the sources of the phenomenon are investigated. ESRO

N71-11365# Laboratoire d'Automatique et de ses Applications Spatiales, Toulouse (France).

CONTRIBUTION TO THE STUDY OF THE STATIC PROPERTIES OF PLANAR THYRISTORS [CONTRIBUTION A L'ETUDE DES PROPRIETES STATIQUES DU THYRISTOR PLANAR]

Gilles Enea (Ph.D. Thesis—Toulouse Univ.) Toulouse Univ. 1970 188 p refs In FRENCH

Avail: NTIS

The different types of thyristors and their manufacture are reviewed and their operation is described with special emphasis on the variation of the current gain of bipolar transistors. Computerized simulation of the operating mode of thyristors is discussed and the program is given in an appendix. As a check for this program radiation effects on thyristors are analyzed. ESRO

N71-11366# Danish Research Centre for Applied Electronics, Copenhagen.

INSULATION RESISTANCE IN PRINTED CIRCUIT BOARDS: AN INVESTIGATION OF A NUMBER OF TYPES MANUFACTURED UNDER VARIOUS CLIMATIC CONDITIONS [ISOLATIONSMODSTAND I PRINTPLADER: EN UNDERSOEGELSE AF EN RAEKKE TYPER OG FABRIKATER UNDER FORSKELLIGE KLIMATISKE FORHOLD]

S. T. Olesen Jul. 1970 38 p ref In DANISH; ENGLISH summary

(ECR-14) Avail: NTIS

The investigation includes measurements of insulation resistance on a number of types and manufactures of printed circuit boards. Insulation has been measured on boards just supplied by the manufacturer as well as on boards exposed to humidity, or placed under conditions of an increased working temperature. A total of 33 different types, distributed into the material categories phenol/paper, epoxy/paper, epoxy/glass, polyester/glass and teflon/glass, has been collected from various industrial consumers and suppliers respectively. In this way it has been possible to get an experimental material which is distributed into several different, independent supplies of boards. The purpose of the project was to investigate how often in practice lots with insufficiently baked material, and consequently with a poor insulation resistance, would occur. However such lots did not occur, and are probably not as frequent as assumed beforehand. Author

N71-11367# Danish Research Center for Applied Electronics, Copenhagen.

HEAT TRANSMISSION IN ELECTRONICS: SIMPLE CALCULATION METHODS FOR VARIOUS HEAT TRANSFER FORMULAS IN ELECTRONIC INDUSTRY [VARMETRANSMISSION I ELEKTRONIK: SIMPLE BEREGNINGSMETODER FOR FORSKELLIGE FORMER FOR-VARMETRANSMISSION I ELEKTRONIKUDSTYR]

A. Laursen Sep. 1970 37 p In DANISH; ENGLISH summary Sponsored by Sammenslutningen for Paalidelighed og Miljoetek.

(ECR-15) Avail: NTIS

When designing electronic equipment it often happens that the thermal properties of the construction are not taken into consideration at an early stage of the development or are insufficiently investigated; it is important to realize the desired thermal properties of the product, i.e. to determine the possibilities of cooling, the shape and size of the cabinet, etc. This report has been written as a contribution to the solution of these problems. The thermal principles have been examined with special reference to electronic equipment. The various formulas are illustrated by examples. Author

N71-11368# Australian National Univ., Canberra. Dept. of Engineering Physics.

USE OF THE HOMOPOLAR GENERATOR TO POWER XENON DISCHARGE TUBES AND SOME ASSOCIATED SWITCHING PROBLEMS

E. K. Inall Mar. 1969 30 p refs

(EP-RR-23) Avail: NTIS

Tests of a homopolar generator with its four rotor discs connected in series to power xenon flash tubes being developed for high-power low-voltage operation are described. An arc developed in the electrolytic switch being used to terminate the pulse. Voltage surges produced by this and other arcs in the flash tube circuits, caused the bus bars to arc over and the current exceeded the capacity of the light duty brushes being used in the generator. Damage within the generator allowed currents of several millions of amperes to flow and these led to damage to the rotors and bearings. An interpretation of the records of the event and the probable sequence are presented. Author

N71-11369# Colorado Univ., Boulder. Dept. of Electrical Engineering.

SYNTHESIS OF HIGH-SPEED HOMOPOLAR ALTERNATORS AND THEORY OF SOLID ROTOR ELECTRICAL MACHINES, PHASE DD. PART 2: THEORY OF SOLID ROTOR INDUCTION MOTORS Final Report

Edward A. Erdelyi and James C. Wilson Dec. 1969 420 p refs

(Contract DA-44-009-AMC-787(T))

(AD-711570) Avail: NTIS CSCL 9/3

After review of the linear two-dimensional theory of solid rotor induction machines, the so-called composite rotor induction motor is analyzed. The rotor consists of layers of various combinations of magnetic and conducting materials. It is shown that by right selection of layer combinations a nearly ideal constant torque motor can be designed. For the consideration of end effects of a short rotor-motor, a three-dimensional linear treatment is developed. The basic partial differential equations are established and boundary conditions described. After a general solution is found, the boundary conditions satisfied in the least square sense yield the necessary constant. The solution shows clearly the end effects influence. Long and short motors are compared. In the two-dimensional nonlinear numerical solution of the solid rotor induction motor the B-H characteristic is represented as a piece-wise linear curve. The solution is obtained by a successive line relaxation technique of the vector potentials and by underrelaxation of the reluctivities. The results show the influence of saturation. Author (TAB)

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N71-11370# Joint Publications Research Service, Washington, D.C.

CYBERNETICS AND REGULATION THEORY

22 Oct. 1970 15 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 193, no. 4, 5, 1970 p 770–776, 1012–1014
(JPRS-51622) Avail: NTIS

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3. FUNCTIONS OF AN ORDERED SAMPLING OF CONTINUOUS VARIABLES I. M. Zolotova p 11–14 refs (See N71-11373 02-10)

N71-11371# Joint Publications Research Service, Washington, D.C.

STUDY OF THE DYNAMICS OF SIMPLEST NONLINEAR PULSE SYSTEMS WITH A DISTRIBUTED LINK

A. S. Alekseyev *In its* Cybernetics and Regulation Theory 22 Oct. 1970 p 1–6 refs (See N71-11370 02-10)
Avail: NTIS

Application of point transformations in the analysis of nonlinear pulse system dynamics with a linear distributed link is demonstrated. The dynamics of a single-loop pulse control system are considered, the schematic of which contains in addition to general feedback, a series connected ideal pulse element, integrating link, static nonlinear link, and a uniformly distributed link described by a linear homogeneous parabolic equation. The boundary problem solution includes the use of Green functions and Fredholm equations. The procedure can be extended to the multidimensional case and the case of an unbounded region. J.M.

N71-11372# Joint Publications Research Service, Washington, D.C.

STRUCTURE OF CONTROL LAWS INSURING ASYMPTOTIC STABILITY OF CONTROL SYSTEMS WITH AN UNSTABLE TARGET

G. A. Stepanyants et al *In its* Cybernetics and Regulation Theory 22 Oct. 1970 p 7–10 ref (See N71-11370 02-10)
Avail: NTIS

Phase-space integrals, linear functions and transformations, vector functions, canonical Jordan forms, and manifolds are included in the proof of the existence and structure of optimal control laws insuring asymptotic stability of control systems with an unstable target. J.M.

N71-11373# Joint Publications Research Service, Washington, D.C.

FUNCTIONS OF AN ORDERED SAMPLING OF CONTINUOUS VARIABLES

T. M. Zolotova *In its* Cybernetics and Regulation Theory 22 Oct. 1970 p 11–14 refs (See N71-11370 02-10)
Avail: NTIS

Definitions are presented and certain properties of two continuous logic functions generalizing the m out of n voting function and the threshold function of binary variables to the continuous case are investigated. Both nonincreasing and nondecreasing orders are considered in the ordered sampling of continuous variables. J.M.

N71-11374# Laboratoire d'Automatique et de ses Applications Spatiales, Toulouse (France).

CONTRIBUTION TO THE STUDY OF LOGIC CIRCUITS USING COMPUTERS [CONTRIBUTION A L'ETUDE DES CIRCUITS LOGIQUES PAR ORDINATEUR]

Michel Diaz (Ph.D. Thesis—Toulouse Univ.) and Gerard Hamalainen (Ph.D. Thesis—Toulouse Univ.) Oct. 1969 260 p refs In FRENCH Sponsored by Direc. Gen. a la Rech. Sci. et Tech.
(LAAS-613-614) Avail: NTIS

Existing computer programs for network analysis, input procedures, and the setting up of equations representing the network are analyzed and their merit discussed. Two equivalent circuits for transistors which are appropriate for computer processing are presented and the methods used to identify the parameters representing the steady state and switching made according to an Ebers and Moll model are explained. ESRO

N71-11375*# Texas Univ., Austin. Information Systems Research Lab.

FEEDBACK DECOUPLING OF TIME DELAY DIFFERENTIAL SYSTEMS

H. H. Bybee and J. K. Aggarwal 1 Aug. 1969 56 p refs
(Contract NAS8-18120; Grants AF-AFOSR-0766E-67; NSF GK-1879)
(NASA-CR-111415; AD-697829; AFOSR-69-2049TR; TR-70)
Avail: NTIS CSCL 12A

Sufficient conditions are derived for the decoupling of certain time delay systems with m inputs and m outputs into m, independent, single input, single output systems. The systems considered are described by linear, time invariant, ordinary, time delay, differential equations in normal state variable form with one constant delay length. A class of state variable feedback is generated to accomplish the decoupling. Author (TAB)

N71-11376*# Westinghouse Research Labs., Pittsburgh, Pa.

DEVELOPMENT OF A PRACTICAL FLEXIBLE SELECTED INTERCONNECTION TECHNIQUE FOR MONOLITHIC CIRCUITS Final Report, Jun. 1967 – Dec. 1969

P. R. Malmberg, G. S. Basi, and L. J. Koos Sep. 1970 91 p
(Contract NAS8-20770)
(NASA-CR-102908) Avail: NTIS CSCL 09C

The development of a practical technique for making custom patterns of interconnections on integrated circuits without the use of masks is discussed. The use of a computer-controlled electron beam is proposed for fabricating these interconnections, and this approach is followed throughout. The program has resulted in a fast and accurate method for automatically laying out an interconnection pattern to connect specified subcircuits so as to perform the desired function, and in the means for creating this pattern in metal at the required scale by electron beam lithography without the use of masks or of any photographic processing. Author

N71-11377# Pennsylvania Univ., Philadelphia.

AN ALGORITHM FOR FAULT ISOLATION OF MULTI-STATE ELECTRONIC NETWORKS

Michael Mesak Vartanian (Ph.D. Thesis) 1969 175 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 69-21448

A problem in fault isolation of electronic networks is that in many cases a large number of measurements must be taken at a relatively large percentage of nodes in order to accurately estimate the parameter values of that network. An algorithm which will estimate these parameters using fewer test points and measurements is presented. This algorithm requires that the network under consideration contain switches (mechanical and/or natural) and have available a number of nodes to be used as test points. Measurements will be taken at these test points and analyzed to estimate the parameters of the network. These estimates are then compared to a list of acceptable values of the parameters, from which a determination is made as to which components must be replaced. Dissert. Abstr.

N71-11378*# Texas Univ., Austin. Information Systems Research Lab.
PERFORMANCE ANALYSIS OF SUBOPTIMAL NON-ADAPTIVE AND OPTIMAL ADAPTIVE DISCRETE KALMAN FILTERS
D. G. Lainiotis and Fred L. Sims 16 May 1969 60 p refs
(Grants NGR-44-012-066; AF-AFOSR-766-67E; AF-AFOSR-1764-69)
(NASA-CR-111414; AD-697828; AFOSR-69-1144TR; TR-65)
Avail: NTIS CSCL 09D

The performance of discrete suboptimal Kalman filters and discrete optimal adaptive filters can be analyzed by an error covariance matrix which is defined on the specific filtering structure. Iterative algorithms for calculating the absolute performance of suboptimal filters are achievable for the case of known modeling errors. For the case of unknown statistical and dynamical system parameter values and optimal Bayesian estimate of the actual system performance provides a means of analyzing the system. Similarly, the parameter value uncertainties in the adaptive filter formulation necessitate an adaptive approach to estimating, in an optimal mean-square-error manner, a measure of actual system performance. The technique leads to an iterative, real-time measure. This proposed performance measure is conveniently formed by weighting conditional error covariance matrices that are obtained from the adaptive filter. Lastly, an adaptive Kalman filtering procedure is presented which minimizes the risk in system identification. Author (TAB)

N71-11379*# Rochester Univ., N.Y. Dept. of Electrical Engineering.
SYNTHESIS OF DISTRIBUTED SYSTEMS Final Report, 1 Sep. 1966 – 31 Aug. 1969
Gerald H. Cohen and Avinash R. Karnik 31 Aug. 1969 150 p refs
(Grant NGR-33-019-058)
(NASA-CR-111809) Avail: NTIS CSCL 09C

A technique is developed for the synthesis and design of a distributed parameter system guiding waves from one point in space to another. The parameter distributions are assumed to be unrestricted except for the upper and lower bounds. The algorithm devised improves the First Order Gradient Technique so that it becomes less sensitive to the initial assumed distributions and virtually eliminates the convergence problems generated because of the bounds on the parameter distributions. A transmission line with distributed series r and shunt c is a particular case of the distributed parameter system. The optimal design of a distributed rc filter for the feedback circuit of an oscillator and the optimal design of a notched filter employing a thin film circuit is an example of the application of the Improved Gradient Technique. These distributions were obtained by the use of a hybrid computer. E.M.C.

N71-11380*# Auburn Univ., Ala. Engineering Experiment Station.
GENERATION AND APPLICATION OF SENSITIVITY COEFFICIENTS Final Technical Report, 29 Oct. 1969 – 27 Sep. 1970
C. L. Phillips 27 Sep. 1970 30 p refs
(Contract NAS8-21368)
(NASA-CR-102912) Avail: NTIS CSCL 09C

Methods for the generation of the first and second order sensitivity coefficients for systems whose input-output relationship is describable by a linear, ordinary, constant coefficient differential equation, are presented in this report. The equation's coefficients may be functions of the system parameters and the order of numerator dynamics may be as great as the order of the denominator dynamics. It is shown that the first order sensitivity coefficients with respect to each parameter, pj, j = 1,2,...,k, may be generated as linear combinations of the signals present in the system and one sensitivity model. The generation of the second order sensitivity coefficients with respect to each parameter pj may be accomplished with k + 1 sensitivity models in addition to the system model. An s-domain proof (Laplace transform) of the often noted symmetry and complete simultaneity property of the first order sensitivities of a system in the companion canonic form is given. Author

N71-11381# Cornell Univ., Ithaca, N.Y.
RAPID COMPUTER AIDED ANALYSIS OF NONLINEAR ELECTRONIC CIRCUITS
Rodney Howard Allen (Ph.D. Thesis) 1969 108 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 69-20963

A digital computer algorithm for analyzing the behavior of nonlinear electronic circuits using the state space approach is described. The nonlinearities are described in terms of the state of the system expressed at the output ports to which the nonlinear elements are attached. The nonlinear system is then defined as a set of first order linear differential equations with nonlinear algebraic side constraints. Several classes of integration rules are examined to discover rules that have no numerical instabilities regardless of the integration time step size. Several cases and orders of Rosenbrock rules are presented. Associated truncation error measurement and control schemes are presented. The computer program which implements this nonlinear, time varying, and adjustable parameter circuit analysis algorithm is described. A simple user's manual for the program appears in an appendix. Several examples are included to demonstrate the use of the program and to test its capabilities. Dissert. Abstr.

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N71-11128# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A DESIGN AND EVALUATION OF AN ION IMPLANTATION SYSTEM
Stephen P. Plusch (M.S. Thesis) Mar. 1970 77 p refs
(AD-712011; GEE/EE/70-20) Avail: NTIS CSCL 20/7

A machine originally designed as a bakeable, monoenergetic sputtering apparatus was redesigned for use as an ion implantation system. Engineering modifications produced a virtually oil-free high-vacuum system. The base pressure of the system (unbaked) in its present configuration is 1 x 10 to the minus 8th power Torr. A 0.8-microamperes, 6.5-keV nitrogen ion beam was obtained. The machine, after modifications, was studied to determine its feasibility as an ion implantation system. If beam voltages greater than 10 kV are used, the machine will be suitable to perform small-area implants (areas approximately equal to 0.5 sqcm) with dopants available in gaseous form (non-corrosive) ranging in energy from 10 to 30 keV. TAB

N71-11422*# General Applied Science Labs., Inc., Westbury, N.Y.
DESCRIPTION AND CAPABILITIES OF A TRAVELING WAVE SONIC BOOM SIMULATOR

Roger Tomboulian and William Peschke Washington NASA Nov. 1970 68 p refs
(Contract NAS1-8940)
(NASA-CR-1696; TR-734) Avail: NTIS CSCL 14B

Studies were made to obtain a more complete understanding of performance range and capability of a traveling wave type sonic boom simulator. Specifically, the studies were concerned with methods and techniques to reduce unwanted jet noise, improved definition of the simulator's operating range, development of non-idealized wave shapes in the simulator and the use of shock wave absorber techniques in the simulator. The simulator was investigated in both a valve operated mode and a diaphram operated mode with the valve mode showing advantages for longer duration and higher overpressure N-waves and the diaphram mode showing advantages for obtaining minimum rise times. Means for substantially reducing the jet noise and for additional attenuation of unwanted high frequencies were indicated. Author

N71-11470# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
THE AEROTHERMODYNAMIC TEST CENTRE OF MODANE-AVRIEUX [LE CENTRE D'ESSAIS AEROTHERMODYNAMIQUES DE MODANE-AVRIEUX]
Marcel Pierre and Guy Fasso 1970 47 p refs In FRENCH; ENGLISH summary
(ONERA-NT-166) Avail: NTIS

The Modane Center supplied directly by water under 800 m pressure and giving up to 88,000 kW includes four wind tunnels and various smaller facilities. The wind tunnels are the S1 continuous 8 m diameter sonic wind tunnel, the S2 continuous 1.80 m square sub-, trans- and supersonic (up to Mach 3) wind tunnel, the S3 0.80 m square blowdown trans- and supersonic (up to Mach 4.5) tunnel and the S4 0.60 to 0.90 m diameter blowdown hypersonic (from 6 to 12 Mach) tunnel. The smaller facilities include vacuum tank exhaust flow simulation and balance calibration benches. Both these and the tunnels as well as tests performed at the Center are described. ESRO

N71-11471# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
RECENT IMPROVEMENTS IN THE ONERA ARC 2 WIND TUNNEL
Jean-Pierre Chevallier 1970 8 p refs Presented at the 33d Supersonic Tunnel Assoc. Meeting, Los Angeles, 7-8 May 1970 Submitted for publication
(ONERA-TP-827) Avail: NTIS

A silastene coating applied inside the arc chamber keeps down heat losses and metal pollution, makes for simplified chamber design, and improves gas heating efficiency. This enables 50-msec tests to be carried out at 50 amagats and temperatures from 7 to 8000 K, with gas pollutions accounting for something like 10%, and with a very greatly reduced proportion of metal impurities, which can be checked spectroscopically. Author (ESRO)

N71-11472# European Space Research and Technology Center, Noordwijk (Netherlands).
THE ANTENNA TEST RANGE AT ESTEC
E. T. Ford Oct. 1969 74 p refs
(ESRO-TN-97-ESTEC) Avail: NTIS

A procedure is proposed for multiple use of this facility. A list of equipment available at the test site and test gear pool is included. A possible expansion of the facility for easier and more accurate use in the future is briefly discussed. ESRO

N71-11473# Royal Aircraft Establishment, Farnborough (England).
THE ALIGNMENT AND PHOTOMETRIC CALIBRATION OF A STAR AND SKYLIGHT SIMULATOR
A. G. Gleave Mar. 1970 41 p refs
(RAE-TR-70037) Copyright. Avail: NTIS

A star and skylight simulation facility, for the comprehensive testing of many aspects of star sensor performance under laboratory conditions, is described. The photometric calibration of the simulated stars relative to the known irradiance of real stars, and the theoretical basis of the calibration are discussed. A brief survey of stellar types is included to explain aspects of the simulation technique. The calibration of the skylight source in terms of a photometric standard is also described, and corrections made for its spectral distribution. The overall accuracy attained in the calibrations is estimated. Author (ESRO)

N71-11474# National Aviation Facilities Experimental Center, Atlantic City, N.J.
VISUAL AIDS FOR SECONDARY AIRPORTS Final Report, Sep. 1968 - May 1970
Thomas H. Paprocki Sep. 1970 35 p
(FAA-NA-70-51; FAA-RD-70-59) Avail: NTIS

A new type lighting and marking system for use at small general aviation type airports under VFR weather conditions was installed at the municipal airport, Ocean City, New Jersey, for evaluation. The system consisted of fluorescent runway edge and approach lighting systems; an incandescent sequenced flashing light system; a Simplified Abbreviated Visual Approach Slope Indicator (SAVASI) system; painted aiming-point runway markings; and retro-reflective centerline and threshold markers. All of these visual aids were evaluated individually, and in addition the fluorescent runway edge lighting fixtures were evaluated in comparison with standard incandescent edge lighting units. It was determined that all of the above mentioned visual systems provided satisfactory guidance under VFR conditions and that the fluorescent type of runway edge light fixture can provide excellent VFR lighting with fewer maintenance problems and lower operating costs than the present standard medium intensity runway edge light fixture. Author

N71-11502# Societe pour le Perfectionnement des Materiels et Equipements Aerospatiaux, Issy-les-Moulineaux (France). Dept. Spatial.
THE SPACE ENVIRONMENT SIMULATION CHAMBER AT TOULOUSE [LA CHAMBRE DE SIMULATION D'ENVIRONEMENT SPATIAL DE TOULOUSE]
M. Prudhomme Paris CNES 1970 26 p In FRENCH Presented at the Space Symp., Rennes, France, 16-19 Jun. 1970; sponsored jointly by CNES, Centre de Perfectionnement Tech., and Fac. des Sci. de Rennes
Avail: NTIS

The simulation chamber being constructed at the Centre National d'Etudes Spatiale (Toulouse) is intended for studying thermal behavior and operation of satellites submitted to space conditions. The site and geometry of this test facility have been designed to accommodate space vehicles of the next decade. The study of the thermal equilibrium of satellites calls for the reproduction with a given accuracy of environmental factors, such as vacuum, heat sinks, and solar radiation. This leads to certain values for the characteristics and performances of the main equipment, namely thermal shielding, thermal generator, pumping system, solar simulator, and attitude control simulator. ESRO

N71-11534# Aerospace Corp., El Segundo, Calif. Lab. Operations.
PERFORMANCE OF A 90-FOOT QUASI-TAPERED ANECHOIC CHAMBER: 120 MHz TO 93 GHz Research Report, Aug. 1967 - May 1969
Robert B. Dybdal, Howard E. King, Jimmy L. Wong, and Cleyon O. Yowell 3 Sep. 1970 49 p refs
(Contract F04701-69-C-0059)
(AD-711646; TR-0059(6230-30)-4; SAMSO-TR-70-305) Avail: NTIS CSCL 14/2

The performance of the ninety foot anechoic chamber at The Aerospace Corporation is summarized. This chamber is a quasi-taper design which tapers from a large rectangular test section to a smaller transmitting section. This design combines the attractive features of both the rectangular and fully tapered chambers. The reflection level of this chamber is sufficiently low to permit radar cross section (RCS) or radiation measurements to be made from VHF to millimeter wavelength frequencies. The geometry, performance, and instrumentation are described. Author (TAB)

N71-11535# Army Electronics Command, Fort Monmouth, N.J.

CLEAN ROOM FOR MICRO-MINIATURIZATION PHOTOGRAPHIC FACILITY

Richard A. Lechner Sep. 1970 22 p refs
(AD-711938; ECOM-3326) Avail: NTIS CSCL 14/2

The report covers the design and construction of a horizontal laminar flow clean room complex which supports the operation of a Borrowdale micro-miniaturization camera. Temperature and humidity controlled ultraclean ambient conditions were provided to assure clean and undistorted photographic masks which are used in the photolithographic process of fabricating micro-miniature circuits. All the rooms of the complex are Class 100 except for a general work space which is Class 100,000. Under clean room conditions, image reductions are only limited by the resolution of the photographic emulsions. Author (TAB)

N71-11536*# Translation Consultants, Ltd., Arlington, Va.

REPORT OF THE MEETING OF THE PERMANENT INTERNATIONAL ASSOCIATION OF HIGHWAY CONGRESSES, TECHNICAL COMMITTEE FOR SKIDDING [COMPTE RENDU DE LA REUNION DES COMITES TECHNIQUES DE LA GLISSANCE DES ASSOCIATIONS INTERNATIONALES PERMANENTES DES CONGRES DE LA ROUTE]

Washington NASA Sep. 1970 41 p refs Meeting held in Zurich, 10–11 Sep. 1970
(Contract NASw-2038)
(NASA-TT-F-13407) Avail: NTIS CSCL 13F

Data concerning measurement of transverse friction factor on concrete highways are provided. Data taken with the use of transverse ribs and grooves on concrete paved roads are compared. Effect of water films on highways is discussed, as well as wear of surfaces by studded tires. Glaze ice problem is studied with a view of combatting its effects on highways. Details of general administrative contractual clauses governing building of government highways by private contractor are examined. Author

N71-11551*# Air Force Cambridge Research Labs., Bedford, Mass.

AN ANALYSIS OF THE VIBRATION ENVIRONMENT AT NORTHROP'S NORWOOD, MASS. TEST FACILITY WITH APPLICATION TO GYRO TESTING

Francis A. Crowley, Henry A. Ossing, and John G. Hogan Jun. 1970 48 p refs Supported in part by NASA and the Northrop Corp. *Its* Environ. Res. Paper No. 325
(NASA-CR-111398; AD-710609; AFCRL-70-0355) Avail: NTIS CSCL 13M

This report describes seismic measurements taken at Northrops inertial test facility, Norwood, Massachusetts under the joint auspices of AFCRL, NASA-ERC, and Northrop Corporation. The purpose of these measurements and subsequent analyses is to characterize the motion environment of the test facility in terms relevant to facility design and guidance-component performance tests. Observations of regional and facility environmental motions are described in terms of second-order statistics that serve as a basis for optimum prediction operators. Approaches are recommended for testing gyro sensitivity to the seismic environment, and for use in gyro performance tests for determination and removal of induced error terms. Author (TAB)

N71-11593# Massachusetts Univ., Amherst. School of Engineering.

DYNAMIC SIMULATION AND CONTROL OF DEEP-SUBMERGENCE VEHICLES

C. C. Hsing and R. V. Monopoli Sep. 1970 70 p refs
(Contract N00014-68-A-0146-6)
(AD-712115; THEMIS-UM-70-5) Avail: NTIS CSCL 13/10

The six-degree of freedom equations of motion for a deep-submergence vehicle are developed and transformed into the state variable form. Vehicle maneuvers for two-dimensional motion are simulated on a digital computer resulting in the trajectories of the vehicle. Also, simulated results are checked against analytical results for different two-dimensional maneuvers. The feasibility of employing a model reference control technique to the vehicle is studied. The model reference control scheme employed is based on Liapunovs direct method and is applicable to nonlinear multivariable plants. The controller synthesis technique leads to a nonlinear control law which specifies the thrusts and torques which should be applied to the vehicle such that the vehicle is forced to follow the model. The advantages of this scheme are (a) vehicle parameters need not be known exactly to synthesize the controller, and (b) a stable system results as part of the design procedure. A disadvantage is that the vehicles six position coordinates and six velocity components must be known to implement the control scheme. It is assumed that these signals may either be measured directly or generated from other measurable signals. The model reference control technique with motion restricted to a plane is discussed. Author (TAB)

N71-11714*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

FACILITY FOR SPACE EXPERIMENTS M512 AND M479

P. G. Parks *In its* Space Process. and Manufacturing 21 Oct. 1969 p 252–261 (See N71-11701 02-15)
Avail: NTIS CSCL 14B

The capability for conducting space manufacturing engineering experiments during an earth-orbital mission are contained within a completely integrated system. This versatile system provides the facility for conducting six experimental tasks and consists of a vacuum work chamber, a control panel and a two kilowatt electron beam welding and heating system. Six experiments: (1) electron beam welding; (2) exotherm brazing; (3) gallium arsenide single crystal growth; (4) exotherm composite material melting; (5) electron beam metal melting; and (6) a series of flammability experiments will be conducted in the facility chamber. Author

N71-11758# Academy of Sciences (USSR), Moscow. Inst. for Space Research.

ALGORITHM FOR ROVING VEHICLE MOTION CONTROL

B. L. Kozlov, L. N. Lupitchev, E. N. Orel, Y. K. Hodarev, and I. V. Shamanov 1970 23 p ref Presented at the 21st Intern. Astronautical Congr., Constance, West Ger., 4–10 Oct. 1970
Avail: NTIS

Investigations in the field of design of completely automatic roving vehicles requires the development of large complex of various devices and, first of all, the control system. The problems of choice of strategy and tactics of a vehicle behaviour are of great importance. An approach to the solution of these problems depends on numerous external factors and, primarily, on the specific conditions of the vehicle motion. One of the possible versions of motion control algorithm for roving vehicles intended for self-dependent motion in the given direction (or to the given point) is presented. A form of one or another version of the control algorithm is basically determined by the information which is used for the control program synthesis. Author

N71-11905# National Aviation Facilities Experimental Center, Atlantic City, N.J.

VISUAL APPROACH SLOPE INDICATOR (VASI) SYSTEM FOR LONG-BODIED AIRCRAFT Final Report, Jan.–May 1970

Robert F. Gates Dec. 1970 34 p refs
(FAA-RD-70-76; FAA-NA-70-59) Avail: NTIS

A comparative evaluation was conducted on two methods of modifying the standard VASIS for use for long-bodied aircraft operations. Modification was required due to the greater pilot eye-to-wheel height of the larger aircraft which placed these aircraft in a potential undershoot situation when the on-course signals of standard VASIS were flown. Thirty-four subject pilots flying a variety of aircraft, including the B-747 and C-5A aircraft, participated in the program. The aircraft were tracked with phototheodolite equipment, and the pilots completed questionnaires at the conclusion of each flight. The three-bar system, a modification consisting of an additional component of the standard VASIS, was a significantly better aid than the white-wing system, a modification incorporating the use of white lights only adjacent to the upwind bar of the standard VASIS. Author

N71-12043# California Inst. of Tech., Pasadena. Arthur Amos Noyes Lab. of Chemical Physics.

SAFETY DEVICES FOR X-RAY DIFFRACTION

Sten Samson [1970] 25 p refs Presented at the Conf. on Radiation Safety in X-ray Diffraction and Spectry., Philadelphia, 6-7 Jan. 1970 Submitted for publication *Its* Contrib. No. 4020
(Grants NSF GP-4237; NSF GP-7984; NSF GP-17504)
Avail: NTIS

Safety devices for single-crystal and power-diffraction apparatus are discussed for use in X-ray diffraction studies. Devices for prevention of radiation exposure from specific parts of the equipment are described including leak-proof joints, X-ray collimators with labyrinth seals and o-rings, beam traps with good trapping cylinders and blind angles, safety shutters with automatic control and warning lights, easy and comfortable alignment of the X-ray focus, and temporary X-ray shielding. General design features that help to prevent accidental X-ray exposure are cited along with diagrams of various parts of the equipment. J.M.

N71-12139# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.

FFA STRUCTURAL RESEARCH AND TEST FACILITIES

1970 63 p
(FAA-61) Avail: NTIS

The Aeronautical Research Institute of Sweden - Flygtekniska Forsoksanstalten (FFA) is discussed. The primary activity of the FFA consists of contract work for the Swedish Air Force and the aircraft industry, as well as indoor research programmes. The FAA has wind tunnels for the static and dynamic testing of various types of aeronautical models, covering the entire range from low subsonic to hypersonic speeds. A special theoretical group deals with aircraft and missile simulation. In the FFA structural test facilities, full-scale structures, sub-assemblies, component and materials are tested under static or dynamic loads at various temperatures. Author

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N71-11129# Boeing Scientific Research Labs., Seattle, Wash. Flight Sciences Lab.

SYMPOSIUM ON AIRCRAFT WAKE TURBULENCE

Sep. 1970 72 p refs Conf. held at Seattle, 1-3 Sep. 1970
(AD-712080; D1-82-0993) Avail: NTIS CSCL 20/4

Session topics: Fundamental problems; Experimental methods; Flow visualization presentations and results; Wake formation and character; Stability and decay of trailing vortices; Aircraft response to wake turbulence; and Control and use of trailing vortices. TAB

N71-11138# Lehigh Univ., Bethlehem, Pa. Dept. of Mechanical Engineering and Mechanics.

THE EFFECT OF NOZZLE GEOMETRY ON THE TOTAL PRESSURE DISTRIBUTION IN WALL JETS ON A CIRCULAR ATTACHMENT WALL AND ON JET-WALL EDGE INTERACTION

Jerzy A. Owczarek, Donald O. Rockwell, and Y.-S. Cha Jun. 1970 66 p refs
(Contract N00014-69-A-0417; Proj. Themis)
(AD-711314; THEMIS-LU-TR-2) Avail: NTIS CSCL 20/4

The report deals with an experimental investigation of the effect of flow nonuniformities existing at the exit of certain planar nozzles on the total pressure distribution in a low-Mach-number wall jet on a circular attachment wall. In addition, a short study of the effects of internal (edge-generated) and external acoustic noise on the total pressure distribution in the wall jet is described. Most tests were run at the Reynolds number, based on the width of the nozzle at the exit and on the average flow speed at the nozzle exit, of 12,400. The tests have shown that the flow nonuniformities existing at the exit of the planar nozzles used have a large effect on the total pressure distribution in the wall jet. In addition, it was found that the internal acoustic noise can produce marked changes in the jet total pressure distribution, especially in the outer layer of the jet. The externally-applied acoustic noise produced similar effects. Author (TAB)

N71-11139# Lehigh Univ., Bethlehem, Pa. Dept. of Mechanical Engineering and Mechanics.

A STUDY OF FLOW FROM TWO PLANAR NOZZLES

Jerzy A. Owczarek, Donald O. Rockwell, and Y.-S. Cha Jun. 1970 43 p refs
(Contract N00014-69-A-0417; Proj. Themis)
(AD-711313; THEMIS-LU-TR-1) Avail: NTIS CSCL 20/4

The report describes an experimental investigation of the characteristics of low-Mach number flow of air from each of two planar nozzles having an aspect ratio of 3 at the exit. The nozzles had rectangular inlets with rounded leading edges to channel the flow from round stagnation tanks. The nozzle which produced nonuniform flow at the exit was tested with and without a flow straightener inside. Most experiments were performed at the Reynolds number, based on the width of the nozzle at the exit and on the average flow speed at the nozzle exit, of 12,400. The tests showed that the planar convergent nozzle having a concave-convex inner wall profile, without a flow straightener in it, produced a very nonuniform total pressure distribution at the exit. The flow visualization study showed that the regions of low total pressure are associated with vortices whose axes have the general direction of the main flow. The planar convergent nozzle having a concave-straight inner wall profile, tested without a flow straightener in it, produced uniform total pressure distribution at the exit outside of the boundary-layer region. Small concentrated vortices were observed to exist inside both nozzles. Author (TAB)

N71-11435*# Scripta Technica, Inc., Washington, D.C.

CALCULATION OF PARAMETERS OF A CAVITATING FLOW IN HYDRAULIC SYSTEMS [K RASCHETU PARAMETROV KAVITATSIONNOGO TECHENIYA V GIDRAVLICHESKIKH SISTEMAKH]

G. S. Nazarov NASA Nov. 1970 12 p refs Transl. into ENGLISH from Izhenero-Fiz. Zh. (USSR), v. 17, Sept. 1969 p 397 – 406
(Contract NASw-2036)
(NASA-TT-F-13340) Avail: NTIS CSCL 20D

A possible use of the Borda – Carnot theorem for calculating the cavitation characteristics in converging channels of different shape is investigated. An equation is obtained for the energy distribution in individual sections of a hydraulic system. Two particular cases of the cavitating flow in converging channels without external energy supply are discussed. It is shown that the beginning of the so-called plateaus of constant flow rate on the flow characteristics corresponds to the moment of formation of a gas-vapor phase at the edges of the channel at the start or end of local convergence. An important role in this phenomenon is played by the wettability of the duct walls, and by the inlet and outlet angles. Author

N71-11453*# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.

VIBRATIONAL RELAXATION MEASUREMENTS OF CARBON MONOXIDE IN A SHOCK-TUBE EXPANSION WAVE

T. Ian McLaren and John P. Appleton May 1970 31 p refs
Its Fluid Mech. Lab. Publ. No. 70-5
(Contracts NAS2-4919; N00014-67-A-0204-0040; ARPA Order 322)
(NASA-CR-111370) Avail: NTIS CSCL 20D

A novel technique has been developed for use in the study of collisional energy transfer and chemical reaction rates in rapidly cooled gases. The principle feature is that the shock heated test gas sample is stationary during the cooling process so that the temporal behavior of a particular nonequilibrium property may be continuously monitored. The technique has been applied to the measurement of the vibrational de-excitation rate of carbon monoxide in an argon heat bath, using the fundamental infrared emission band of CO to follow its vibrational temperature throughout the expansion. In contrast to a number of recent reports indicating enhanced vibrational de-excitation rates for some diatomic molecules, the present experiments clearly indicate that the characteristic vibrational relaxation time of carbon monoxide in argon is the same no matter whether it is measured in a compression (shock wave) or expansion environment. Author

N71-11475# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.

APPLICATIONS OF A GENERAL METHOD OF CALCULATING TURBULENT SHEAR LAYERS

P. Bradshaw and D. H. Ferriss (Natl. Phys. Lab., Teddington, Engl.) Oct. 1970 30 p refs
(IC/70/06) Avail: NTIS

A calculation method using a differential equation for the turbulent shear stress was successfully applied to boundary layers with compressibility, heat transfer, three dimensionality or unsteady flow, with an empirical input obtained almost entirely from low speed flow at constant pressure. With numerical changes in the empirical input the method was extended to duct flows and free shear layers. Running times are typically 5 to 10 sec on a CDC 6600 or five times this on an IBM 7094. Author

N71-11503# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.

TIME-DEPENDENT TECHNIQUES FOR THE SOLUTION OF VISCOUS, HEAT CONDUCTING, CHEMICALLY REACTING, RADIATING DISCONTINUOUS FLOWS

Ephraim L. Rubin Dec. 1969 19 p refs Presented at the Conf. on Numerical Soln. of Differential Euqations, Dundee, Scotland, 23–27 Jun. 1969
(Contract Nonr-839(34))
(AD-711954; PIBAL-69-50) Avail: NTIS CSCL 20/4

It is shown how the integral equations of inviscid hydrodynamics may be written in conservation form for arbitrary curvilinear coordinate systems. A second order accurate difference scheme for three space dimensions and time is derived directly from the integral equations. Finally, the behavior of the linearized difference approximation is examined and a necessary and sufficient condition for stability for three-dimensional cartesian coordinates is derived. The second part of the paper is devoted to the application of these difference schemes to viscous, heat conducting, chemically reacting radiating shocked flows. Author (TAB)

N71-11504# Oak Ridge National Lab., Tenn. Technical Information Div.

MOLECULAR FLOW OF GASES THROUGH TUBES WITH REGARD TO VARIOUS PARTICLE-WALL INTERACTION PROCESSES. PART 2: EXPERIMENTAL EVALUATION OF DEVIATIONS FROM KNUDSEN'S LAW FOR STEADY FLOW

W. Teubner (Technische Universitat, Dresden) 1969 14 p refs Transl. into ENGLISH from Vakuum-Tech. (West Ger.), v. 16, no. 5, 1967 p 95–101 Sponsored by AEC
(PB-190568T; ORNL-tr-2298) Avail: NTIS CSCL 01A

By means of experiments, the steady molecular flow of He, Ne and Ar through a glass capillary in a temperature range of 20 to 450C was studied. The results of two measurements are used in each case to determine parameters which characterize the gas-wall interactions and therefore also deviations from Knudsen's law. The interaction parameters comprise the absorption of molecules and the return of particles from the wall into the volume in preferred directions. Deviations from Knudsen's law caused by the latter process prevail over the deviations due to sorption of particles. Author (USGRDR)

N71-11505# Stanford Univ., Calif. Thermosciences Div.

THE MECHANICS OF A PERTURBATION WAVE IN TURBULENT SHEAR FLOW

A. K. M. Fazle Hussain and William C. Reynolds May 1970 199 p refs
(Contract F44620-69-C-0010; Grant NSF GK-10034)
(AD-711414; SU-FM-6; AFOSR-70-1655TR) Avail: NTIS CSCL 20/4

The behavior of controlled wave disturbances in turbulent channel flow was studied experimentally and theoretically. The work is relevant to Landahls waveguide theory of shear turbulence. It is shown that the interaction between the organized waves and the turbulence must be considered in such a theory. Author (TAB)

N71-11510# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

HOLOGRAPHIC INTERFEROMETRY BY RETRO-DIFFUSION [INTERFEROMETRIE HOLOGRAPHIQUE PAR RETRO-DIFFUSION]

Jean-Marie Caussignac 1970 5 p refs In FRENCH Presented at the Intern. Symp. on Holography, Besancon, France, 6–11 Jul. 1970 Submitted for publication
(ONERA-TP-852) Avail: NTIS

Interferential holography permits the visualization of fluid flows inside aerodynamic wind tunnels. In case of turbomachinery, only a retro-diffusion setup can be considered. The material connexion of the diffuser to the wind tunnel entails new constraints. The paper deals with the problems related to the diffuser: displacements and deformations. ESRO

N71-11519# Virginia Polytechnic Inst., Blacksburg. Dept. of Engineering Mechanics.

INCOMPRESSIBLE LAMINAR BOUNDARY LAYERS ON A PARABOLA AT ANGLE OF ATTACK: A STUDY OF THE SEPARATION POINT

M. J. Werle and R. T. Davis Aug. 1970 29 p refs
(Contract N00014-70-C-0024)
(AD-712084; VPI-E-70-17) Avail: NTIS CSCL 20/4

The laminar boundary-layer equations were solved for incompressible flow past a parabola at angle of attack. Such flow experiences a region of adverse pressure gradient and thus can be employed to study the boundary-layer separation process. The present solutions were obtained numerically using both implicit and Crank Nicholson type difference schemes. It was found that in all cases the point of vanishing shear stress (the separation point) displayed a Goldstein type singularity. Based on this evidence, it is concluded that a singularity is always present at separation independent of the mildness of the pressure gradient at that point. Author (TAB)

N71-11520*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

BOUNDARY-LAYER TRANSITION STUDY OF SEVERAL POINTED BODIES OF REVOLUTION AT SUPERSONIC SPEEDS

William A. Cassels and James F. Campbell Washington Nov. 1970 69 p refs

(NASA-TN-D-6063; L-7159) Avail: NTIS CSCL 20D

Boundary-layer transition by the sublimation and impact-pressure techniques and force tests were performed on three Haack–Adams bodies of revolution of fineness ratios 7, 10, and 13 at zero angle of attack for free-stream Mach numbers of 2.00, 2.75, and 4.63 and a range of Reynolds numbers based on model length of 6 to 15,000,000 with and without a roughness strip. The grit method of inducing turbulence was found to provide for a nearly complete turbulent flow over the models at the lower Mach numbers and higher Reynolds numbers considered, while the amount of trip drag was less than 8 percent of the model drag with transition fixed. A method of interpreting sublimation data is discussed and used and the results compare well with the impact-pressure results. Author

N71-11521*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECT OF INTERACTING VORTICES ON JET PENETRATION INTO A SUPERSONIC STREAM

Martin Hersch and Louis A. Povinelli Washington Nov. 1970 22 p refs

(NASA-TM-X-2134; E-5766) Avail: NTIS CSCL 20D

Helium, at sonic velocities, was injected into the interaction region of a counter-rotating vortex pair, a single vortex, and a vortex-free flow field in a Mach 2 free stream. The vortex pair and the single vortex were generated by injectors having double and single swept edges, respectively, at a 6 deg angle of attack. Penetration of 12 jet diameters downstream from the injection orifice was 11 to 18 percent greater for the double-tip injector than for the single-tip injector. Injection pressure was varied from 60 to 100 psia (415,000 to 689,000 N/sq m). Total free-stream pressure was 0.92 atmospheres (93,000 N/sq m). Author

N71-11532*# Scientific Translation Service, Santa Barbara, Calif.

METHOD OF SUCCESSIVE APPROXIMATIONS FOR THE INTEGRATION OF EQUATIONS OF A LAMINAR MULTI-COMPONENT BOUNDARY LAYER WITH CHEMICAL REACTIONS INCLUDING IONIZATION [METOD POSLEDOVATELNYKH PRIBLIZHENIY DLYA INTEGRIROVANIYA URAVENENIY LAMINARNOGO MNOGOKOMPONENTNOGO POGRANICHNOGO SLOYA S KHIMICHESKIMI REAKTSIYAMI VKLYUCHAYA REAKTSII IONIZATSII]

G. A. Tirskiy Washington NASA Nov. 1970 102 p refs Transl. into ENGLISH of Moscow State Univ. Inst. of Mech. Conf. Paper p 1–52 Presented at 21st Intern. Astronaut. Congr., Constance, West Ger., 4–10 Oct. 1970

(Contract NASw-2035)

(NASA-TT-F-13379) Avail: NTIS CSCL 20D

The two-dimensional stationary boundary layer equations of an asymtotically thin boundary layer are solved using the method of successive approximation. A multicomponent gas with chemical reactions and ionization is considered. The method was tested and found to be accurate to 1%. Author

N71-11533*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A TIME-DEPENDENT METHOD FOR CALCULATING SUPERSONIC BLUNT-BODY FLOW FIELDS WITH SHARP CORNERS AND EMBEDDED SHOCK WAVES

Richard W. Barnwell Washington Nov. 1970 67 p refs

(NASA-TN-D-6031; L-7284) Avail: NTIS CSCL 20D

A time-dependent numerical method for calculating supersonic blunt-body flow fields with sharp corners and embedded shock waves is presented. Axisymmetric and symmetric plane bodies can be treated. The method of characteristics is used at the bow shock wave and body surface, and a two-step finite-difference method of second-order accuracy is used between the shock and body. A stability analysis of the finite-difference equations which accounts for the effects of a nonorthogonal coordinate system is presented. Calculations for flow over bodies with sharp and rounded corners are compared with experimental and other theoretical results. The influence of a parabolic free-stream velocity distribution on the flow over a spherically blunted cone is investigated, and a study of the effect of Mach number on the flow about a truncated cone is made. Author

N71-11543# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

USE OF PERTURBATION METHODS FOR THE STUDY OF LAMINAR FLOWS: APPLICATION TO SEPARATION PROBLEMS [EMPLOI DES METHODES DE PERTURBATION POUR L'ETUDE DES ECOULEMENTS LAMINAIRES: APPLICATION AUX PROBLEMES DE SEPARATION]

Claude Francois (Ph.D. Thesis—Paris Univ., 1 Jun. 1970) 1969 164 p refs In FRENCH; ENGLISH summary

(ONERA-P-128) Avail: NTIS

Two-dimensional, laminar, and incompressible viscous flows, when the Reynolds number tends either to zero or to infinity, are studied using essentially perturbation methods. The limiting forms of the Navier-Stokes equations, the matching conditions between two contiguous domains, and the asymptotic behavior of the solutions near a wall, are investigated systematically. The results obtained are applied to several problems more or less related to separation phenomena, namely: flow configurations and singularities in the vicinity of a leading edge, of a trailing edge and of wedge, laminar boundary layer separation, base flow problem at high Reynolds number, low Reynolds number flow past a circular cylinder, and a flat plane. The main results are summarized in a conclusion. Author (ESRO)

N71-11548*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

THEORETICAL PRESSURE DISTRIBUTIONS OVER ARBITRARILY SHAPED PERIODIC WAVES IN SUBSONIC COMPRESSIBLE FLOW AND COMPARISON WITH EXPERIMENT

K. R. Czarnecki and Mary W. Jackson Washington Nov. 1970 35 p refs

(NASA-TN-D-5984; L-7124) Avail: NTIS CSCL 20D

The theoretical solution for the pressure distribution over an infinitely repeating set of sinusoidal waves in subsonic, compressible flow is extended to the area of arbitrarily shaped, periodic waves by the use of Fourier series, and a simplified or approximate solution for the calculation of first-order effects is developed. The solutions are compared with experimental pressure distributions determined at Mach numbers of 0.70 and 0.90 on six types of finitely repeating roughness elements incorporated into the cylindrical portions of a group of ogive cylinders. Discrepancies between theory and experiment are discussed in detail. Author

N71-11549*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

A METHOD FOR ANALYZING THE INTERACTION OF AN OBLIQUE SHOCK WAVE WITH A BOUNDARY LAYER

William C. Rose Washington Nov. 1970 20 p refs

(NASA-TN-D-6083; A-3714) Avail: NTIS CSCL 20D

A method is presented for predicting the characteristics of an interaction produced by an externally generated, oblique shock wave that impinges on either laminar or turbulent bounday layers. The basis of the method is the assumption that the boundary layer in the interaction region may be divided into two layers: the outer layer, an essentially inviscid but rotational layer, and the inner layer, an essentially viscous layer. Coupling of the inner and outer flows throughout the interaction region is discussed. The only empirical information required for using the method is the extent of upstream propagation of the pressure rise. Correlations for the length of upstream influence, based on parameters consistent with the two-layer hypothesis, are presented. Results predicted by the method are compared with experimental results in terms of surface pressure distributions, heat transfer, and flow-field configuration. Author

N71-11550*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ZERO-GRAVITY EQUILIBRIUM CONFIGURATION OF LIQUID-VAPOR INTERFACE IN TOROIDAL TANKS

Eugene P. Symons Washington Nov. 1970 25 p refs
(NASA-TN-D-6076; E-5839) Avail: NTIS CSCL 20D

The configuration of the liquid-vapor interface for a wetting liquid in a toroidal tank during weightlessness is observed for a range of percent liquid volumes, tank sizes, and initial conditions. Results are presented in photographic and chart form and compared with previous data. The final liquid-vapor interface configuration is shown to be dependent on tank mounting angle, percentage of liquid volume, and tank proportion. Author

N71-11563# Columbia Univ., New York. Dept. of Civil Engineering and Engineering Mechanics.

VISCOUS FLOW OF A SUSPENSION OF DEFORMABLE LIQUID DROPS IN A CYLINDRICAL TUBE

William A. Hyman and Richard Skalak Jun. 1970 105 p refs
(Contract N00014-67-A-0108-0003)
(AD-711633; TR-5) Avail: NTIS CSCL 20/4

Viscous flow in a circular cylindrical tube containing an infinite line of deformable liquid drops equally spaced along the tube axis is considered. The fluid within the drops as well as the suspending fluid is taken to be Newtonian and incompressible. A surface tension is assumed to act at the interface. Two types of solutions are developed depending on the magnitude of the distortion of the drop shape from spherical. A perturbation solution is employed for nearly spherical drops. In this case the flow of the suspending fluid and liquid drops under an imposed pressure gradient is a linear combination of the solutions obtained for (1) the axial translation of the drops, and (2) the flow of the suspending fluid past the drops. For large deformations the problem is no longer linear in these two flows. An approximate numerical technique is employed for this case which yields the drop shape as well as the other parameters of the flow. The results show that both drag and pressure loss per drop increases with both increasing drop spacing and radius. The internal motion of the drops reduces the drag and pressure gradients as compared with rigid spheres of equal volume. Further, due to the deformation, the overall resistance decreases with increasing flow rate. This constitutes a mechanism of non-Newtonian behavior of the suspension as a whole. Author (TAB)

N71-11596# Ballistic Research Labs., Aberdeen Proving Ground, Md.

AN APPLICATION OF FLETCHER-POWELL OPTIMIZATION TECHNIQUE TO BLAST THEORY

Palmer R. Schlegel Aug. 1970 13 p ref
(AD-711886; BRL-1489) Avail: NTIS CSCL 19/4

The Fletcher-Powell optimization procedure is used to obtain a constrained least-squares approximation to discrete pressure-time data. The data were obtained from a finite difference analog of the non-steady flow equations describing axisymmetric flow impinging upon a rigid wall. Author (TAB)

N71-11654# Pisa Univ. (Italy).

FABRICATION TECHNIQUES OF COMPACT FLUIDIC CONTROL EQUIPMENT FOR AEROSPACE ENGINES

R. Lazzeretti, G. Nardi, and D. Dini *In* AGARD Advanced Technol. for Production of Aerospace Eng. Sep. 1970 25 p refs (See N71-11626 02-28)
Avail: NTIS

First attempts to produce fluidic elements made use of photosensitive plastics. Now, for industrial applications, superior materials and production techniques must be used. Methods using photosensitive ceramics, electroerosion, metal microfusion, etc., are described herein. Block combinations for modular systems and complex logic units, having the distinct advantage of small, compact assemblies, are presented. These include binary counters cascades, comparators, converters, sequential circuits, liquid level sensors and entire logic circuits suitable for control of gas turbines and aerospace engines. Also fluidic carburation and fuel injection control on reciprocating engines are discussed. Very simple, low cost fluidic control systems for industrial applications exhibit many superior qualities. Finally, methods suitable for the economical fabrication of compact and reliable control equipment for aerospace engines are investigated. Author

N71-11683*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CAVITATION AND NONCAVITATION PERFORMANCE OF 78 DEG HELICAL INDUCER IN HYDROGEN

Phillip R. Meng and Royce D. Moore Washington Nov. 1970 13 p refs
(NASA-TM-X-2131; E-5745) Avail: NTIS CSCL 20D

The performance of a 78 deg helical inducer mounted in an inlet line with a stationary centerbody was determined in hydrogen over a temperature range of 36.6 to 40.1 R(20.3 to 22.3K) and a flow coefficient range of 0.088 to 0.130 at 25,000 and 30,000 rpm. The inducer net positive suction head requirement increased with increasing flow coefficient and rotative speed and decreased with increasing hydrogen temperature. Noncavitating head-rise coefficient, which decreased with increasing flow coefficient, was unaffected by liquid temperature and rotative speed. Author

N71-11721*# Georgia Inst. of Tech., Atlanta.

THEORETICAL INVESTIGATION OF GAS MANAGEMENT IN ZERO GRAVITY SPACE MANUFACTURING

Helmut F. Bauer and Julius Siekmann *In* NASA. Marshall Space Flight Center Space Process. and Manufacturing 21 Oct. 1969 p 346-350 refs (See N71-11701 02-15)
Avail: NTIS CSCL 20D

The proposed research has as its objective the management of gases in liquefied materials in a free suspended position in zero gravity environment. The investigation shall mainly center on the degassing of liquefied materials, which shall be accomplished by accelerating the material. Also the gas-liquid-interaction, as well as methods to distribute gas properly in liquefied materials of various viscosity and surface tension shall be studied. Author

N71-11751# Ballistic Research Labs., Aberdeen Proving Ground, Md.

FLOW IN MODEL ROOMS CAUSED BY AIR SHOCK WAVES

George A. Coulter Jul. 1970 364 p refs
(AD-711885; BRL-MR-2044) Avail: NTIS CSCL 20/4

Experimental results and two-dimensional computer code predictions are shown which illustrate the internal air flow inside model rooms when loaded externally by air shock waves in a 5-20 psi range. Stagnation and side-on fill pressure records are presented for three-dimensional models which indicate that flow patterns similar to those observed in the two-dimensional study are present inside the three-dimensional models. Baffles were placed inside the

entrances of the models which re-directed the air flow to positions off the entrance centerline and gave more safe floor area.
Author (TAB)

N71-11752# Office of Naval Research, London (England).
INTERNATIONAL SYMPOSIUM ON RAREFIED GAS DYNAMICS (7th)
I. Estermann 10 Aug. 1970 13 p Symp. held at Pisa, Italy, 29 Jun. – 3 Jul. 1970
(AD-711419; ORNL-C-20-70) Avail: NTIS CSCL 20/4

About 175 persons from 18 countries participated in the Symposium and over 100 papers dealing with kinetic theory, gas-surface interaction, rarefied flows, shock waves, molecular beam techniques as applied to gas dynamics, and plasma flow were presented. The report contains a discussion of about 35 papers mainly from the fields of kinetic theory, gas furface interaction, and molecular beam applications.
Author (TAB)

N71-11767# Royal Aircraft Establishment, Farnborough (England).
SINGLE IMPACT STUDIES OF RAIN EROSION. PART 1: PRELIMINARY EVALUATION
A. A. Fyall and P. Smith Apr. 1969 38 p refs
(RAE-TR-69086) Copyright. Avail: NTIS

Techniques of high speed photography, photomicrography, and profilometry were applied to the study of single impacts of waterdrops with fast-moving surfaces. Various features of the collision process are described including pressure build-up, radial velocity, flow separation, and obliquity of surface. Interpretations are given of the damage sites and of their possible correlation with multiple impact erosion. Photoelastic studies of impact indicate that prestressing of the target surface may occur before collision, and the implications of this phenomenon for high altitude flight are discussed.
Author

N71-11955# Naval Postgraduate School, Monterey, Calif.
AN EXPERIMENTAL INVESTIGATION OF THE VORTEX-BREAKDOWN PHENOMENON
Turgut Sarpkaya 30 Jul. 1970 66 p refs
(AD-711831; NPS-59SL0071A) Avail: NTIS CSCL 20/4

The results of an experimental investigation of the characteristics of stationary and travelling vortex breakdowns in swirling flow in a diverging cylindrical tube are presented and discussed. Basically, three types of vortex breakdown were observed viz., double helix, spiral, and axisymmetric breakdown. The type and location of the stationary breakdowns were found to be dependent upon the Reynolds and circulation numbers of the flow. The breakdown bubble responded to gradual and abrupt changes in the upstream and downstream flow conditions in a manner analogous to the hydraulic jump in open-channel flow. The observations reported and the evidence presented revealed unmistakably that the vortex breakdown is a finite transition from a uniform state of swirling flow (supercritical) to one (subcritical) featuring a large standing wave, followed by standing wavelets, of finite amplitude.
Author (TAB)

N71-11973# Johns Hopkins Univ., Baltimore, Md. Dept. of Mechanics.
DETECTION OF THE TURBULENT-NON-TURBULENT INTERFACE Interim Technical Report
Valdis Kibens and Leslie S. G. Kovasznay Durham, N.C. AROD Jun. 1970 65 p refs
(Contract DA-31-124-ARO(D)-313)
(AD-712375; AROD-5413-6-E; ITR-1) Avail: NTIS CSCL 20/4

A new method was developed to form an intermittency function I(t) (ON for turbulent, OFF for non-turbulent flow) using an analog circuit. The detection process is based on a signal proportional to a spatial derivative of velocity: two adjustable detection parameters are used, namely, a threshold and a memory or hold-time. Methods are given for determining the optimum values of the detection parameters for a given flow using a two step procedure. First the detector cirucit performance is calibrated using a synthetic signal of known properties, and then measurements in the particular flow are related to the calibration tests to determine optimum settings. Detailed description is given of the detector circuit and of a circuit for generating a synthetic turbulence signal. Methods of determining detection errors and difficulties met in using the detection method in particular flows are discussed. An analytic model of the detection process is presented.
Author (TAB)

N71-12070# Boeing Scientific Research Labs., Seattle, Wash. Flight Sciences Lab.
ORDERLY STRUCTURE IN JET TURBULENCE
S. C. Crow and F. H. Champagne Jul. 1970 99 p refs
(AD-711969; DI-82-0991) Avail: NTIS CSCL 20/4

A study was made to determine whether jet turbulence is orderly in any sense, and whether the order can be enhanced and controlled by a slight periodic surging imposed at the jet exit. The technological motivation for the study was jet noise. To the extent that turbulent mixing can be accomplished by an orderly process, a new range of noise-suppression techniques becomes available, and the problem of predicting jet noise becomes much simpler.
Author (TAB)

N71-12078# Asian Inst. of Tech., Bangkok (Thailand). Hydraulic Lab.
CHARACTERISTICS OF RADIAL WALL JET BOUNDED BY CIRCULAR JUMP
Wei-Chun Wan (M.S. Thesis) 1970 110 p refs
(Rept-284) Avail: NTIS

Characteristics of a radial wall jet and a circular hydraulic jump created by the radial flow of a circular jet spread as a thin layer on a smooth flat plate were studied. The characteristics being considered were: the laminar and turbulent flow profiles, variation of free surface velocity, energy and momentum coefficient, boundary layer development, momentum equation and energy dissipation of the circular hydraulic jump, length, height and location of the jump in term of pertinent dimensionless parameters. The analysis of the radial wall jet was made using the boundary layer theory of an axisymmetric flow. Experiments were conducted to verify the theoretical equations.
Author

N71-12079# Asian Inst. of Tech., Bangkok (Thailand).
CHARACTERISTICS OF THE JET OF A TWO DIMENSIONAL ORIFICE PAST A RECTANGULAR PLATE
Tang-Huei Wang (M.S. Thesis) 1970 58 p refs
(Rept-308) Avail: NTIS

The characteristics of a free jet issuing from a two dimensional orifice past a rectangular plate placed symmetrically and normal to the flow were studied. Because of the symmetricity along the center line of the channel, the problem was analyzed only considering the half-plane analysis as a two dimensional eccentric jet. The analysis was made using Zhukovskii's method of free streamlines analyses, the application of Schwarz-Christoffel theorem, and a technique of integration across free streamlines. The theoretical equations were obtained to express the coefficient of contraction and the angle of deflection as functions of the boundary geometry. The solutions of some limiting cases of the problem were verified by the mathematical and experimental results from previous investigators.
Author

N71-12140# Office of Naval Research, Washington, D.C.
FIFTH SYMPOSIUM ON DETONATION
1970 526 p refs Conf. held at Pasadena, Calif. 18-21 Aug. 1970 Prepared in cooperation with NOL
(AD-712081- ONR-DR-163) Avail: NTIS CSCL 19/4

Preprints on various papers on condensed phase detonation presented at The Fifth Symposium (International) on Detonation. The major areas covered are: Detonation and related flows; Unsteady detonations and detonation structure; Non-steady reactive shocks; Mostly initiation by non-shock stimuli; Experimental techniques; Flow dynamics and thermodynamics; Experiments on shocks and flows. TAB

N71-12163# Johns Hopkins Univ., Baltimore, Md. Dept. of Mechanics.

LARGE SCALE MOTION OF A TURBULENT BOUNDARY LAYER WITH A ZERO AND A FAVORABLE PRESSURE GRADIENT Interim Technical Report

Ron Blackwelder and Leslie S. G. Kovasznay Jul. 1970 160 p refs
(Contract DA-31-124-ARO(D)-313)
(AD-712330; AROD-5413-7-E; Rept-2) Avail: NTIS CSCL 20/4

The outer intermittent region of a fully developed turbulent boundary layer with a zero and a strongly favorable pressure gradient was extensively investigated in order to clarify the complex interplay between the strongly retarded inner turbulent fluid and the outer irrotational fluid. The investigation also shed light on the role of the large eddy structure which appears to dominate the outer region. Author (TAB)

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N71-11130# Signatron, Inc., Lexington, Mass.

INVESTIGATION OF ATMOSPHERIC PARAMETERS WITH FORWARD SCATTER PROBING Final Report, 6 Jan. 1969 – 15 Jun. 1970

Phillip A. Bello, Peter Alexander, and S. Ahmad Meer 19 Jun. 1970 159 p refs
(Contract F19628-69-C-0176)
(AD-712088; AFCRL-70-0397) Avail: NTIS CSCL 4/1

The report is concerned primarily with evaluating the potentiality of a high resolution forward scatter system to detect refractive index fluctuations caused by clear air turbulence. A justification for the use of the forward scattering approach to atmospheric probing is obtained by examination of available experimental results. Computer programs were developed to relate the spatial characteristics of refractive index and the link parameters (antenna pointing, beamwidths, etc.) to the multipath characteristics of the link. The program includes such effects as anisotropy, shadowing due to the radio horizon, and off-axis antenna pointing. A possible CAT measurement procedure is discussed which involves a narrow beam scanning antenna and a fixed wide beam antenna coupled with a measurement of channel delay power spectrum. Attention is given to the advantages of measuring the channel delay-Doppler scattering function. Author (TAB)

N71-11147# Lowell Technological Inst. Research Foundation, Mass.

ACCURATE SECOND-ORDER THEORY FOR TRANSIONOSPHERIC PROPAGATION

Bodo W. Reinisch Dec. 1969 177 p refs
(Contract F19628-68-C-0259)
(AD-711394; SCIENTIFIC-2; AFCRL-70-0068) Avail: NTIS CSCL 4/1

Measurements on high frequency signals from beacon satellites are used for calculation of the ionospheric columnar electron content. An array of antennae and a complex receiving system were necessary to measure dispersive Doppler shift, Faraday rotation and ionospheric refraction simultaneously on three frequencies: 20, 40 and 41 MHz. Main emphasis is given to the development of a new second-order theory for phase path difference which considers, besides refraction and geomagnetic field effects, also the sphericity of the ionosphere. The correction terms caused by the sphericity dominate the second-order terms caused by the ray refraction. For several satellite passes the significance of the second-order effects is demonstrated. Author (TAB)

N71-11151*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

SECOND ANNUAL EARTH RESOURCES AIRCRAFT PROGRAM STATUS REVIEW. VOLUME 3: HYDROLOGY AND OCEANOGRAPHY

1969 372 p refs Conf. held at Houston, Tex., 16-18 Sep. 1969
(NASA-TM-X-66481) Avail: NTIS CSCL 08H

Conference papers are presented on hydrological and oceanographic studies, and the use of aerial and spaceborne photography, infrared imagery, radar detection, and remote sensing in the studies. For individual titles see N71-11152 through N71-11170.

N71-11152*# Geological Survey, Raleigh, N.C.

APPLICATION OF INFRARED IMAGERY IN STUDYING THERMAL CHARACTERISTICS OF A COOLING RESERVOIR

J. F. Turner, Jr. *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 3 1969 10 p (See N71-11151 02-13)
Avail: NTIS CSCL 08F

Heat disposal at the cooling reservoir for a large steam-electric generating plant involves circulating large quantities of cooling water from the lake through the condensing coils of the generators and then back to the lake. Detailed information on lake surface temperature was obtained by infrared imagery during overflight with subsequent data processing and interpretation in developing a thermal map of the reservoir. Although only one set of infrared imagery was obtained during the study, it is concluded that low-altitude, predawn remote sensing flights made during clear weather, will provide information needed in mapping surface temperatures of cooling reservoirs. Even though the imagery was obtained during adverse weather conditions, portions of the imagery accurately described temperature variations in the reservoir and allowed the development of a thermal map. Author

N71-11153*# Geological Survey, Anchorage, Alaska. Water Resources Div.

HYDROLOGIC STUDIES IN NORTHERN COOK INLET, ALASKA USING COLOR PHOTOGRAPHY AND THERMAL IMAGERY

W. W. Barnwell and Chester Zenone *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 3 1969 17 p refs (See N71-11151 02-13)
Avail: NTIS CSCL 08H

Photography and thermal infrared imagery of the Northern Cook Inlet area in south-central Alaska were obtained. The color photographs provided sharp detail in landscape features, and thermal infrared imagery enabled delineation of swampy areas from well-drained areas. Color differences on the color infrared photographs correlated with warm and cold ground detected by the thermal infrared imagery. Both color and thermal patterns indicate current directions in Cook Inlet, where cool silt-laden fresh water mixes with the salt water. Author

N71-11154*# Geological Survey, Washington, D.C.

RELATION OF REMOTE SENSING TO TRANSPIRATION OF FLOOD PLAIN VEGETATION

Richard C. Culler and Raymond M. Turner *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 3 1969 8 p refs (See N71-11151 02-13)
Avail: NTIS CSCL 08H

The amount of water vapor lost from plants through transpiration is in part a function of the volume of plant material covering a given area. If the variance in plant material through time and space is known, it should be possible to make certain inferences regarding the amount of transpiration through the same time period and over the same area. It is this varying plant volume that is measured by the use of readily available aerial photographic techniques and materials. Author

N71-11155*# Geological Survey, Washingon, D.C. Water Resources Div.

SYNOPTIC REMOTE-SENSING SURVEY OF LAKES IN WEST-CENTRAL FLORIDA

Joseph W. Stewart *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 3 1969 33 p refs (See N71-11151 02-13)
Avail: NTIS CSCL 08H

Remote sensing from aircraft has useful application in lake studies of west-central Florida. Thermal infrared imagery and photography in the visible and near infrared range of the electromagnetic spectrum provide a detailed synoptic record over a large area during a near-instantaneous time interval. Both natural color and infrared color photography were obtained for this study. The color infrared photography was preferred: (1) in hydrologic studies based upon vegetative indicators; (2) in delineation of shoreline boundaries; and (3) in qualitative evaluations of depth and turbidity. However, color infrared photographs appear unnatural because health vegetation is a shade of red and turbid water tends to be a shade of pale green or pale blue. Natural color photographs provide an image similar to that sensed by the human eye and are a helpful addition for proper interpretation of phenomena represented on the color infrared photographs. Author

N71-11156*# Geological Survey, Washington, D.C.

REMOTE SENSING OF OFFSHORE SPRINGS AND SPRING DISCHARGE ALONG THE GULF COAST OF CENTRAL FLORIDA

J. D. Hunn and R. N. Cherry *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 3 1969 7 p refs (See N71-11151 02-13)
Avail: NITS CSCL 08H

Color photography can be used to detect possible offshore springs submerged in shallow water. Identification of the possible springs and sinkholes on the photographs becomes increasingly difficult as their size on the image decreases. The temperature contrasts, as indicated by the 8-14 micron imagery and observed spring discharge, occurred where predicted by the project hypothesis. The imagery showed the contrasting temperatures of sea-and aquifer-water and confirmed the existence of fresh-water discharge. The most easily interpreted results were obtained immediately before dawn when ground-water temperatures were warmer than the Gulf of Mexico. When ground-water temperatures are colder than the Gulf, nighttime or early morning thermal contrasts related to offshore spring discharge could be mistaken for areas of the Gulf bottom exposed at low tide. Author

N71-11157*# American Univ., Washington, D.C. Dept. of Biology.

THE USE OF COLOR INFRARED PHOTOGRAPHY AND THERMAL IMAGERY IN MARSHLAND AND ESTUARINE STUDIES

Richard R. Anderson *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 3 1969 30 p refs (See N71-11151 02-13)
Avail: NTIS CSCL 08H

Presented are results obtained from data provided by two overflights. The following conclusions may be made: (1) color infrared photography was superior to natural color in marshland plant-community delineation, particularly with increase in altitude; (2) there is considerable tonal change in marsh vegetation during the growing season, reflecting a decline of some species and a succession of others; (3) color infrared photography is superior to natural color in detecting sources and distribution of sediment in estuarine water; (4) sunglint from water may be avoided without undue degradation of the tone quality of the marshland vegetation; (5) infrared imagery of this area indicates that certain marsh species may be differentiated by temperature-sensing instruments. Sources of ground water and heated water from a power plant are also delineated. Author

N71-11158*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

A THERMAL SURVEY OF THE CONNECTICUT RIVER ESTUARY

F. H. Ruggles, Jr. *In its* 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 3 1969 12 p ref (See N71-11151 02-13)
Avail: NTIS CSCL 08H

The effects of atomic power plant heated effluent on the marine life in river estuary were studied by water measurements and aerial infrared imagery. Analysis of thermal data mapping indicated heat plume flow patterns of the heated effluent until it fully occupied the estuary on a downstream flow. These data indicated the heat plume dispersion and revealed differences in river water flow density. G.G.

N71-11159*# Geological Survey, Miami, Fla.

APPLICATIONS OF MULTISPECTRAL DATA COLLECTION AND PROCESSING TECHNIQUES APPLIED TO HYDROBIOLOGICAL INVESTIGATIONS IN EVERGLADES NATIONAL PARK, FLORIDA

Aaron L. Higer, Milton C. Kolipinski, Norma S. Thomas, and Fred J. Thomson *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 3 1969 27 p refs Prepared in cooperation with Michigan Univ., Ann Arbor (See N71-11151 02-13)
Avail: NTIS CSCL 08H

Mapping of hydrobiological features with multiband scanner imagery was tried for the first time on a strip of land eight miles long and 2,000 feet wide. This was done by electrically processing selected combinations of video signals in the narrow spectral bands between 0.4 and 1.0 micrometers to obtain recognition maps for tree islands, emergent aquatic grassland, and various surface-water depths. The computer recognition maps of individual hydrobiological features were printed in different colors and superposed to provide a color composite map of the area. This technique has potential for use in the hydrobiological evaluation of marsh, swamp and other shallow-water areas. Author

N71-11160*# Geological Survey, Tacoma, Wash.

SNOW AND ICE SENSING WITH PASSIVE MICROWAVE AND GROUND TRUTH INSTRUMENTATION: RECENT RESULTS, SOUTH CASCADE GLACIER

M. Meier and A. T. Edgerton *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 3 1969 15 p refs Prepared in cooperation with Aerojet-Gen. Corp., El Monte, Calif. (See N71-11151 02-13)
Avail: NTIS CSCL 08L

Field experiments utilizing a multifrequency microwave radiometry field laboratory were conducted in the Pacific Northwest to assess the effects of melting, layering surface roughness, density variations, etc. on microwave emission and to determine effective penetration as a function of sensor wavelength. Laboratory studies involved measurement of the dielectric properties of snowpacks at microwave frequencies. Analytical modeling consisted of formulation of models to describe vertically structured media in which both the dielectric properties and physical temperature are permitted to vary with depth. During field studies, the investigators experienced difficulty in obtaining reliable ground truth measurements of snow moisture. To improve confidence in this measurement, a series of tests were conducted on the South Cascade Glacier where several techniques for determining snow moisture were compared. The investigators are also analyzing 1.55-cm imagery of Mount Rainier where effects of terrain slopes parallel and perpendicular to the flight line are encountered. These data correspond to a variety of snow and ice conditions. Author

N71-11161*# Geological Survey, Townson, Md.

USE OF INFRARED RADIOMETRY IN MEASURING GROUND-WATER INFLOW TO STREAMS, DELMARVA PENINSULA, MARYLAND AND DELAWARE

Este F. Hollyday *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 3 1969 15 p refs (See N71-11151 02-13)
Avail: NTIS CSCL 08H

A convective heat budget is used to calculate ground-water inflow to small alluvial streams. Stream temperatures are measured radiometrically from aircraft flying along a stream; upstream discharge and ground-water inflow temperature are measured by a ground team. Ground-water inflow temperature are measured by a ground team. Ground-water inflow and downstream discharge may be calculated for any desired subreach within the reach flown. Time required for data collection may be greatly reduced as compared with time required to make a seepage run. Ground-water inflow to a reach of Beaverdam Creek near Milton, Delaware, is calculated to be 5.7 cubic feet per second, which agrees within 11 percent with the inflow determined by standard stream-gaging techniques. Downstream discharge is calculated to be 9.1 cubic feet per second, which agrees within 7.5 percent. Author

N71-11162*# Geological Survey, Washington, D.C.

PRELIMINARY REPORT ON REMOTE SENSING IN WATER-RESOURCES STUDIES IN YELLOWSTONE NATIONAL PARK, WYOMING

Edward R. Cox *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 3 1969 10 p (See N71-11151 02-13)
Avail: NTIS CSCL 08H

Data obtained from remote sensing should be useful in locating bodies of cool ground water near thermal-water areas in Yellowstone National Park. Remote-sensing data, particularly infrared imagery, from aircraft missions are being studied, and methods of interpretation are being developed to correlate remote-sensing and ground-truth data. Test areas are being established where hydrologic ground-truth data can be obtained to correlate with imagery. Areas that show promise for correlation of imagery and ground-truth data are outlined. Patches of snow observed correlated exactly with relatively cool areas interpreted from infrared imagery. Author

N71-11163*# Kansas Univ., Lawrence. Remote Sensing Lab.

SNOWFIELD MAPPING WITH K-BAND RADAR

William P. Waite and Harold C. MacDonald *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 3 1969 22 p refs (See N71-11151 02-13)
Avail: NTIS CSCL 08L

Analysis of K-band imagery from several geographic areas where snowfields occur has provided evidence that the distribution of perennial snow results in an anomalously high signal return. In contrast to normal snow survey methods, it appears feasible to map the areal extent of old snow areas irrespective of most weather conditions, and even when covered with new fallen snow. Author

N71-11164*# Hulbert (E. O.) Center for Space Research, Washington, D.C.

PASSIVE MICROWAVE STUDIES

James P. Hollinger *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 3 1969 12 p refs (See N71-11151 02-13)
Avail: NTIS CSCL 08J

The results of the Argus Island Tower measurements over a range of incidence angles and for a range of sea states are summarized as follows: (1) the general forms of the dependence of vertical and horizontal components of the brightness temperature of the sea on incidence angle are given by simple calculations; (2) vertical component is independent of sea state between about 50 to 60 degrees incidence angle; (3) vertical component increases below and decreases above about 55 degrees incidence angle with increasing sea state; (4) horizontal component increases with increasing sea state; (5) polarization decreases with increasing sea state at a rate which increases with increasing incidence angle; (6) foam greatly enhances the emissivity of the sea; and (7) the surface disturbance due to rain has much less effect on the emissivity of the sea than does foam. Author

N71-11165*# Kansas Univ., Lawrence.

RADAR AND OCEANOGRAPHY

Richard K. Moore and Gerald Bradley *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 3 1969 30 p refs (See N71-11151 02-13)
Avail: NTIS CSCL 08J

The discussion of sea-state measurements is in three parts: (1) description of the results from Missions 70 and 88 of the NASA Earth Resources Aircraft Program; (2) description of the scatterometer system used in that program at 13.3 GHz; and discussion of the problems in validating the data obtained with this scatterometer. Studies of a technique for constructing spacecraft scatterometers using radiometer-like receivers show that this technique can yield precision measurements with less power than would otherwise be required for the transmitter; a microwave radiometer can indeed be used to calibrate the atmospheric attenuation for the scatterometer. Analysis of the tracking errors for a split-gate radar altimeter show that such a system can theoretically have accuracies of the order of a few tens of centimeters or better. Work studies indicate that the primary cause of radar return from the sea at angles away from the vertical is very fine structure whose height is of the order of the radar wave length. Author

N71-11166*# California Univ., San Diego. Scripps Inst. of Oceanography.

SEA-SURFACE TEMPERATURE AND HEAT FLOW: BOMEX

E. D. McAlister *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 3 1969 16 p (See N71-11151 02-13)
Avail: NTIS CSCL 08J

A two-wavelength infrared radiometer system for airborne measurement of the total energy exchange at the sea surface was tested at sea. These tests involved the first use of an airborne digital data reduction system for the output of this radiometer. Data were recorded on tape for repeated 30 second flights. In spite of severe weather conditions, tests on several days showed values of heat flow from 0.50 cal at 18 knots wind speed to 0.05 cal during intermittent rain squalls. These values result from simultaneous readings of radiation at two wavelengths from the sea, sky, the two reference blackbodies and their temperatures. Thirty thousand such readings are recorded in the 30 second fly-by and all are used to obtain the heat flow values. This is the first time that airborne total heat flow measurements have been made. The accuracy of sea-surface temperature measurements made with this system approaches 0.01 C. Author

N71-11167*# TRW Systems Group, Redondo Beach, Calif.

EXPERIMENTAL RESULTS OF THE REMOTE MEASUREMENT OF OCEAN COLOR

Peter G. White *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 3 1969 10 p refs (See N71-11151 02-13)
Avail: NTIS CSCL 08J

The data described were taken with one instrument from a number of locations—they include measurements of the spectral characteristics of water taken in the Pacific and Atlantic oceans and in Crater Lake in Oregon. In all cases the measurements were made remotely from an aircraft flying at altitudes between 1000 and 10000 feet. Results indicate the following characteristics of water spectra: (1) high particle content increases reflectivity between approximately 0.5 and 0.6 micron; (2) high particle contents near the surface decrease reflectivity between 0.4 and 0.5 micron and increase it between 0.6 and 0.7 micron. This effect is minimized if there is a layer of clear water above the particles; and (3) certain absorption bands can be recognized. Author

N71-11168*# Philco-Ford Corp., Palo Alto, Calif. SRS Div.

EXPERIMENTS IN OCEANOGRAPHIC AEROSPACE PHOTOGRAPHY: BEN FRANKLIN SPECTRAL FILTER TESTS

D. S. Ross and Reece C. Jensen *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 3 1969 32 p (See N71-11151 02-13)
(Contract N62306-69-C-0072)
Avail: NTIS CSCL 08J

The spectral region of primary interest for oceanographic remote imaging sensors occurs within a passband approximating 400 to 580 millimicron. This includes the region of least light attenuation in clear water and a large percentage of coastal waters, where maximum depth penetration is possible and significant changes in upwelling luminosity occur. The practice in black-and-white aerial photography, however, is to reject image light at wavelengths shorter than 500 millimicron in order to suppress effects of atmospheric haze. Four-band multispectral photography with red, green, blue, and blue-green filters—taken on flights over a submersible when on the surface and at 10, 15, and 25 meters in the Gulf Stream—produced data confirming the utility of a blue filter band for oceanographic purposes. In addition, the results of the photographic evaluation were confirmed by measurements of the downward spectral irradiance made from within the submersible using a scanning spectroradiometer. Author

N71-11169*# Michigan Univ., Ann Arbor.

DEPTH DETERMINATION BY MEASURING WAVE SURFACE EFFECTS

F. C. Polcyn *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 3 1969 24 p refs (See N71-11151 02-13)
Avail: NTIS CSCL 08J

Wave refraction due to shoaling is under investigation as one method which may be used to determine depth of water by remote sensing techniques. The forward velocity of individual waves decreases appreciably when the wave passes over an area in which the water depth is less than one-half the water wavelength. By photographing the wave surface and measuring the wavelength changes, an estimate of water depth is feasible. By using optical processing techniques to form the Fourier transform of the wave pattern, a method may be found to systematically search a number of aerial or space photographs to locate unknown shallow waters. So far, a number of space photographs and aerial photographs have been analyzed and measures of depth have been obtained whenever the wavelengths were sufficiently long to be affected by the shallow depths. Transforms have been obtained without scanning to prove first the feasibility of measuring wavelength change. Author

N71-11170*# New York Univ., N.Y. Dept. of Biology.

THE STUDY OF COASTAL ECOLOGY USING REMOTE PHOTOGRAPHY

Mahlon G. Kelly *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 3 1969 17 p (See N71-11151 02-13)
Avail: NTIS CSCL 08A

Photointerpretation of aerial photography aided by field surveys has been used at three test sites in the region of the Florida Straits in order to determine the application of such photography to coastal ecological studies. It was found that the photography enabled identification and location of major unusual or unrecognized features, mapping and generalization of biotic bottom cover, and delineation of ecological relationships. Man-made features and pollution could be identified and studied. Author

N71-11392# Royal Aircraft Establishment, Farnborough (England).

THE UPPER ATMOSPHERE AND ITS INFLUENCE ON SATELLITE ORBITS

D. G. King-Hele May 1969 21 p refs
(RAE-TR-69102) Copyright. Avail: NTIS

The chief variations in upper-atmosphere density are described, and it is shown how each of them affects the orbits of close earth satellites. The main features discussed are: (1) the irregular variations in density dependent on solar activity, which may cause great changes in a few days, as well as a 27-day recurrence tendency; (2) the day-to-night and semiannual variations in density, which cause nearly-periodic changes in orbits: for the day-to-night variation the period is usually between 2 months and 2 years, while the semiannual effect leads to maxima of density in April and October, and minima in January and July; and (3) the large changes in density during a sunspot cycle, which reveals a 10- or 11-year recurrence tendency. The changes in orbital inclination caused by the rotation of the atmosphere are also briefly described. Author

N71-11393*# Techtran Corp., Glen Burnie, Md.

MEASUREMENTS OF THE DAYTIME AIRGLOW IN THE 1800–1600 A REGION BY THE COSMOS-224 SATELLITE [IZMERENIZA DNEVNOGO SVECHENIYA ATMOSFERY V OBLASTI 1800–6000 A NA SPUTNIKI KOSMOS-224]

V. A. Krasnopolskiy Washington NASA Nov. 1970 10 p refs Transl. into ENGLISH from Geomagn. Aeron. (USSR), v. 10, no. 4, 1970 p 638–642
(Contract NASw-3027)
(NASA-TT-F-13396) Avail: NTIS CSCL 04A

Filter measurements of the brightness of the airglow near the horizon have shown that aerosol scattering plays an insignificant role in daytime airglow at heights above 130 km. The diurnal pattern of the airglow is characterized by the relationship cos Z(Z = the zenith angle of the sun). The cloud structure is not an inherent part of the daytime airglow. The zenith intensities for the individual components of the airglow are given. The airflow at heights above 130 km does not exceed 100 R at night in the 1800 to 6000 A range. Author

N71-11394# Royal Aircraft Establishment, Farnborough (England).

COMPARISON OF AIR DENSITIES DERIVED FROM THE ORBITS OF 1966-51A, B AND C

D. G. King-Hele and Diana W. Scott Mar. 1969 21 p refs
(RAE-TR-69054) Copyright. Avail: NTIS

On 9 June 1966 three satellites were launched into polar orbits with perigee heights near 180 km and apogees near 3600 km. They were Secor 6 (1966-51B), a rectangular box of mass 17 kg and length 0.33 m; ORS 2 (1966-51C), a regular octahedron of side 0.23 m and mass 5 kg; and the final-stage Agena rocket (1966-51A), of length at least 6 m. Analysis of the extensive orbital data on these three satellites gives 260 values of air density at heights near 190 km. Comparison of these values provides a severe test of the accuracy of the orbital data and methods of analysis, and shows that the accuracy is at least as good as has previously been estimated. The comparison also reveals that the effective cross-sectional area of Secor 6 oscillated with an amplitude of about 10%, with minima when perigee was near the equator and maxima at latitudes near 70 deg. As a consequence, the amplitude of the semiannual variation in air density previously obtained for Secor 6 should be reduced from 1.45 to 1.40. Other findings are that the effective cross-sectional areas of the satellites never approached their extreme possible values, and that the effective area of 1966-51A changed by less than 10% from week to week. Author

N71-11417# Lamont Geological Observatory, Palisades, N.Y.

ARCTIC MARINE GEOPHYSICS AND OCEANOGRAPHY Annual Report, 1 Apr. 1969 – 31 Mar. 1970

Kenneth Hunkins 31 Mar. 1970 22 p refs
(Contract N00014-67-A-0108-0016)
(AD-711626) Avail: NTIS CSCL 8/10

A year-round research program was conducted at Fletchers Ice Island (T-3) in the central Arctic Ocean. The program covered a wide range of oceanographic studies and included marine geology and geophysics, physical and chemical oceanography as well as underwater acoustics. Author (TAB)

N71-11423*# Scripta Technica, Inc., Washington, D.C.

INVESTIGATION OF THE P-WAVE VELOCITY AND COMPRESSIVE STRENGTH OF BULGARIAN ROCK SPECIMENS AT HYDROSTATIC PRESSURES UP TO 9000 kg/sq cm [ISSLEDOVANIYE SKOROSTEY PRODOLNYKH VOLN I PROCHNOSTI NA SZHATIYE V OBROZTSAKH GORNYKH POROD BOLGARII PRI VSESTORONNIKH DAVLENIYAKH DO 9000 kg/sq cm]

M. P. Volarovich et al NASA Oct. 1970 19 p refs Transl. into ENGLISH from Tr. Inst. Fiz. Zemli, Akad. Nauk SSSR (Moscow), no. 37 (204), 1966 p 118 – 127
(Contract NASw-2036)
(NASA-TT-F-13209) Avail: NTIS CSCL 08G

P-wave velocities and compressive strengths under monaxial compression with simultaneous hydrostatic loading were studied for Bulgarian rocks. As hydrostatic pressure increased to 10,000 kg/sq cm, P-wave velocities increased by 10-42%. Hydrostatic pressure increases the compressive strengths of granite and marble several times. Author

N71-11424*# Scripta Technica, Inc., Washington, D.C.

EFFECT OF HIGH PRESSURE ON THE P-WAVE VELOCITY IN GNEISSES AND CRYSTALLINE SCHISTS OF NORTHWESTERN PART OF THE KOLA PENINSULA [VLIYANIYE VSOKOGO DAVLENIYA NA SKOROST PRODOLNYKH VOLN V GNEYSAKH I KRISTALLICHESKIKH SLANTSAKH SEVERO-ZAPADNOY CHASTI KOLSKOGO POLUOSTROVA]

N. Ye. Galdin NASA Oct. 1970 30 p refs Transl. into ENGLISH from Tr. Inst. Fiz. Zemli, Akad. Nauk SSSR (Moscow), no. 37 (204), 1966 p 98 – 117
(Contract NASw-2036)
(NASA-TT-F-13208) Avail: NTIS CSCL 08G

Three groups of rocks from the three characteristic suites of the region were tested under laboratory conditions at up to 12,000 kg/sq cm. Petrographic characteristics and photomicrographs of cross sections of the specimens are presented. Observed reflecting boundaries of the area are correlated to P-wave velocities of rocks taken from the area as functions of pressures and related deposition depths. Author

N71-11431*# Scripta Technica, Inc., Washington, D.C.

THE INFLUENCE OF TEMPERATURE ON ELASTICITY MODULUS OF ROCKS AT HIGH PRESSURE [O VLIYANII TEMPERATURY NA MODUL UPRUGOSTI GORNYKH POROD PRI VYSOKOM DAVLENII]

Z. I. Stakhovskaya NASA Oct. 1970 7 p refs Transl. into ENGLISH from Tr. Inst. Fiz. Zemli, Akad. Nauk SSSR (Moscow), no. 37 (204) 1966 p 157 – 160
(Contract NASw-2036)
(NASA-TT-F-13211) Avail: NTIS CSCL 08G

The simultaneous effects of pressure and temperature on the elastic properties of rocks in static bending tests were investigated. The results show that the Young modulus increases sharply at room temperature up to 1000 kg/sq cm, after which the rate of increase is slower. An increase in temperature in specimens under high hydrostatic pressure produces a significant change in the elasticity of the specimens, indicating that the Young modulus should be considered when interpreting field geophysical data. Author

N71-11432*# Scripta Technica, Inc., Washington, D.C.

STUDY OF THE ELASTIC PROPERTIES OF ROCKS IN THE PECHENGA REGION OF THE KOLA PENINSULA AT HIGH PRESSURES IN RELATION TO ITS DEEP STRUCTURE [ISSLYEDOVANIYE UPRUGIKH SVOYSTV GORNYKH POROD PECHENSKOGO RAYONA KOLSKOGO POLUOSTROVA PRI VYSOKIKH DAVLYENIYAKH V SVYAZI S YEGO GLUBINNYM STROYENIYEM]

N. Ye. Galdin NASA Oct. 1970 48 p refs Transl. into ENGLISH from Tr. Inst. Fiz. Zemli, Akad. Nauk SSSR (Moscow), no. 37 (204) 1966 p 68 – 97
Contract NASw-2036)
(NASA-TT-F-13207) Avail: NTIS CSCL 08G

Elastic wave velocities were determined in rocks from the Pechenga region of the Kola Peninsula, in cooperation with deep seismic sounding studies of the area. The geological structure of the region is discussed, as are the petrographic features of the rocks in the Pechenga series. The data produced in laboratory studies of velocity are used, together with field seismic data, as the basis for a suggested structure for the region, a part of a deep, linear depression deposited on the Archean basement in the Proterozoic era. Author

N71-11434*# Scripta Technica, Inc., Washington, D.C.

INVESTIGATION OF ELECTRICAL RESISTANCE OF BASIC, ULTRABASIC AND ALKALINE ROCKS AND MINERALS AT HIGH PRESSURES AND TEMPERATURES [ISSLEDOVANIYE ELEKTROSOPROTIVLENIYA OSNOVNYKH, ULTRAOSNOVNYKH I SHCHELOCHNYKH GORNYKH POROD I MINERALOV PRI VYSOKIKH DAVLENIYAKH I TEMPERATURAKH]

M. P. Volarovich et al NASA Oct. 1970 20 p refs Transl. into ENGLISH from Tr. Inst. Fiz. Zemli Akad. Nauk SSSR (Moscow), no. 37 (204) 1966 p 168 – 179
(Contract NASw-2036)
(NASA-TT-F-13212) Avail: NTIS CSCL 08G

The two-electrode method using direct current and electromagnetic sounding was used in the experiments. The studies show that the change in resistance is greatest for alkaline rocks, reaching several orders of magnitude in some specimens as opposed to less than one order in basic and ultrabasic rocks, in the pressure range of 1 to 25,000 kg/sq cm. Author

N71-11438*# Scripta Technica, Inc., Washington, D.C.

VELOCITIES OF LONGITUDINAL WAVES AT HIGH HYDROSTATIC PRESSURES IN METAMORPHIC, EFFUSIVE AND SEDIMENTARY ROCK SPECIMENS FROM CENTRAL

KAZAKHSTAN [SKOROSTI PRODOLNYKH VOLN PRI VYSOKIKH VSESTORONNYKH DAVLENIYAKH V OBRAZTSAKH METAMORFICHESKIKH, EFFUZIVNYKH I OSADOCHNYKH POROD TSENTRALNOGO KAZAKHSTANA]
M. P. Volarovich et al NASA Oct. 1970 14 p refs Transl. into ENGLISH from Tr. Inst. Fiz. Zemli, Akad. Nauk SSSR (Moscow), no. 37 (204), 1966 p 52-60
(Contract NASw-2036)
(NASA-TT-F-13205) Avail: NTIS CSCL 08G

P-wave velocities were studied in metamorphic, effusive, and sedimentary rock specimens from Central Kazakhstan at 0.5-1 MHz under laboratory conditions. Velocities are presented in tables and graphs as functions of density and mineral composition of the rocks. Velocity changes in the first 3,000 kg/sq cm pressure range are greatest, and result from secondary changes in rocks, pore space configuration, and factors related to the rocks. Author

N71-11439*# Scripta Technica, Inc., Washington, D.C.
VELOCITIES OF LONGITUDINAL WAVES AT HYDROSTATIC HIGH PRESSURES IN INTRUSIVE ROCK SPECIMENS FROM CENTRAL KAZAKHSTAN [SKOROSTI PRODOLNYKH VOLN PRI VSESTORONNIKH VYSOKIKH DAVLENIYAKH V OBRAZTSAKH INTRUZIVNYKH POROD TSENTRALNOGO KAZAKHSTANA]
M. P. Volarovich et al NASA Oct. 1970 11 p refs Transl. into ENGLISH from Tr. Inst. Fiz. Zemli, Akad. Nauk SSSR (Moscow), no. 37 (204) 1966 p 46-51
(Contract NASw-2036)
(NASA-TT-F-13204) Avail: NTIS CSCL 08G

One hundred specimens of igneous, sedimentary, and metamorphic rock from Central Kazakhstan were cut into cylinders and P-wave velocities were measured along the axis of highest velocity. Tables and graphs illustrate the variations of velocity with pressure. A tendency toward increasing velocity in granite specimens at high hydrostatic pressure with increasing age was noted. Author

N71-11440*# Scripta Technica, Inc., Washington, D.C.
ELECTRICAL CONDUCTIVITY OF IGNEOUS ROCKS OF THE KOLA PENINSULA AT HIGH TEMPERATURE [ELEKTROPROVODNOST IZVERZHENNYKH GORNYKH POROD KOLSKOGO POLUOSTROVA PRY VYSOKIKH TEMPERATUREAKH]
A. T. Bondarenko NASA Oct. 1970 14 p refs Transl. into ENGLISH from Tr. Inst. Fiz. Zemli, Akad. Nauk SSSR (Moscow), no. 37 (204), 1966 p 192-199
(Contract NASw-2036)
(NASA-TT-F-13214) Avail: NTIS CSCL 08G

Electrical conductivity of igneous rocks was measured in the laboratory on the basis of dc transmission in two directions. Graphs of the measurements had several sections, resulting from different conductivity mechanisms: impurity conductivity at low temperature, ionic conductivity at medium temperatures (700-1200 C), and equalization of current carriers per unit volume near the melting point of the rock. Author

N71-11449# RSC Industries Inc., Washington, D.C.
STUDY OF NAVOCEANO'S PERFORMANCE AND DETERIORATION DATA COLLECTION PROGRAM PLAN, TASK 2 Semimonthly Progress Report No. 3
15 Sep. 1970 24 p
(Contract N62306-70-C-0355)
(AD-711632) Avail: NTIS CSCL 8/10

The report is a study which analyzes, interprets, and describes the statistical parameters of oceanographic instruments and includes reliability and availability indices. Author (TAB)

N71-11450*# Scripta Technica, Inc., Washington, D.C.
VELOCITIES OF ELASTIC WAVES AT PRESSURES UP TO 10000 Kg/sq cm IN CHLORITE SHALES FROM SOUTH SAKHALIN [SKOROSTI UPRUGIKH VOLN PRI DAVLYENIYAKH DO 10000 kg/sq cm V KHLORITOVYKH SANTSAKH YUZHNOGO SAKHALINA]
M. P. Volarovich et al NASA Oct. 1970 11 p refs Transl. into ENGLISH from Tr. Inst. Fiz. Zemli, Akad. Nauk SSSR (Moscow, no. 37 (204), 1966 p 61-67
(Contract NASw-2036
(NASA-TT-F-13206) Avail: NTIS CSCL 08G

Elastic wave velocities at high pressures are studied for chlorite shales from South Sakhalin in order to help trace a boundary in the deep structure reported on the basis of deep seismic soundings. It is concluded that the Conrad boundary is the boundary for reflected and refracted waves from the layer of chloritic schists which crops out at Uyunovka quarry. This is consistent with available data on the metamorphic nature of basalt layer. Author

N71-11451*# Scripta Technica, Inc., Washington, D.C.
ELECTRICAL PROPERTIES OF SEDIMENTARY ROCK UNDER HYDROSTATIC PRESSURE [ELEKTRICHESKIYE SVOYSTVA OSADOCHNYKH GORNYKH POROD V USLOVIYAKH VSESTORONNEGO DAVLENIYA]
M. P. Volarovich et al NASA Oct. 1970 11 p refs Transl. into ENGLISH from Tr. Inst. Fiz. Zemli, Akad. Nauk SSSR (Moscow), no. 37 (204), 1966 p 200-205
(Contract NASw-2036)
(NASA-TT-F-13215) Avail: NTIS CSCL 08G

The electrical properties of sedimentary rock specimens were studied under laboratory conditions at pressures of up to 3,000 kg/sq cm. The influence of pressure on specific resistance and dielectric permeability was found to vary with moisture content. High pressures almost totally eliminated frequency dispersion of specific resistance. Changes in the electrical properties varied from a few percent to several hundreds of percent. Author

N71-11452*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
THE COMPETITIVE REACTION OF O(D-1) WITH OZONE AND NITROUS OXIDE
C. S. Goldman 7 Nov. 1970 56 p refs
(Grant NGL-009-003)
(NASA-CR-111378; SR-365) Avail: NTIS CSCL 04A

The competitive reactions of O(1D) atoms with ozone and nitrous oxide were studied: (1) O(1D) + O3 yields 2O2; (2) O(1D) + N2O yields O2 + N2; and (3) O(1D) + N2O yields 2NO. The values of k sub 2/k sub 9 and k sub 9a/k sub 9b were determined from the photolysis of ozone at 2288 and 2537 A. Experiments show that the value of K sub 9a/k sub 9b depends on the pressure of added helium. This result is interpreted in terms of the excess translational energy possessed by the O(1D) atoms. Author

N71-11498*# Scripta Technica, Inc., Washington, D.C.
INVESTIGATION OF THE FREQUENCY DEPENDENCE OF ELECTRICAL PROPERTIES OF IGNEOUS ROCKS FROM THE KOLA PENINSULA [ISSLEDOVANIYE CHASTOTNOY ZAVISIMOSTI ELEKTRICHESKIKH SVOYSTV IZVERZHENNYKH GORNYKH POROD KOLSKOGO POLUOSTROVA]
M. P. Volarovich et al NASA Oct. 1970 21 p refs Transl. into ENGLISH from Tr. Inst. Fiz. Zemli, Akad. Nauk SSSR (Moscow), no. 37(204), 1966 p 206-220
(Contract NASw-2036)
(NASA-TT-F-13216) Avail: NTIS CSCL 08G

Studies of the frequency dependence of the electrical properties of igneous rocks were performed under laboratory conditions at up to 10 to the 7th power Hz. The slight frequency dispersion found was related to ion-relaxation polarization with various relaxation times. Anisotropy in dielectric permeability reached 30%. The results of the laboratory tests agreed with field measurements. Author

N71-11499*# Scripta Technica, Inc., Washington, D.C.

P-WAVE VELOCITIES AT HIGH PRESSURES IN LIQUID-CONTAINING SEDIMENTARY ROCKS OF THE CARPATHIAN AREA [SKOROSTI PRODOLNYKH VOLN PRI VYSOKIKH DAVLENIYAKH V SODERZHASHCHIKH ZHIDKOSTI OSADOCHNYKH PORODAKH PRIKARPATYA]

M. P. Volarovich et al NASA Oct. 1970 14 p refs Transl. into ENGLISH from Tr. Inst. Fiz. Zemli, Akad. Nauk SSSR (Moscow), no. 37(204), 1966 p 149–156
(Contract NASw-2036)
(NASA-TT-F-13210) Avail: NTIS CSCL 08G

Both water and kerosene were used to fill the pores of the rocks. The P-wave velocities were higher in liquid filled than in dry specimens throughout the range studied (1-4,200 kg/sq cm), although the nature of the filler did not affect the velocity greatly. Author

N71-11500# Lamont Geological Observatory, Palisades, N.Y.

PATTERNS OF RELATIVE RELIEF, SLOPE, AND TOPOGRAPHIC TEXTURE IN THE NORTH ATLANTIC OCEAN

Troy L. Holcombe and Bruce C. Heezen Apr. 1970 214 p
(Contract N00024-67-C-1186)
(AD-711339; TR-8) Avail: NTIS CSCL 8/10

The study utilizes what is already known about the distribution of North Atlantic Physiographic provinces in the preparation of a series of charts which schematically illustrate selected functions of relative relief, slope, and topographic texture. The data employed in compiling these charts was obtained by digitizing high resolution fathograms and, measuring relief, slope, and texture through the use of digital computers. Methods of data reduction and chart preparation are described in section 2 of this report. Statistical indices from slope data have been computed which characterize each physiographic province in the North Atlantic. From the charts and statistical data, it has been possible to briefly and quantitatively describe North Atlantic topography and to call attention to a number of interesting relationships and characteristics observed in the data which have a bearing on the geologic history and geomorphology of the Atlantic. Author (TAB)

N71-11509# Texas A&M Univ., College Station. Coastal and Ocean Engineering Div.

OCEAN ENGINEERING PROGRAMS: PRESENT STATUS AND FUTURE DEVELOPMENT

John B. Herbich Jun. 1970 18 p refs Presented at the Am. Soc. for Eng. Educ. Ann. Meeting, Columbus, Ohio, 22–25 Jun. 1970
(Grant NSF GH-59)
(PB-193566; TAMU-SG-70-111; COE-125) Avail: NTIS CSCL 05I

The nature of an ocean engineering graduate program as well as its relation to existing disciplines is briefly discussed. Ocean engineering programs are at a developmental stage at many institutions and a concerted effort needs to be made to give them definition and rough bounds. Existing programs in ocean engineering (mostly on graduate level) were reviewed and are summarized in the paper. Information related to degree programs, number of courses, number of faculty and students, degrees awarded is presented. Author (USGRDR)

N71-11511# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

NOMOGRAMS FOR CALCULATING THE DEPTHS OF PERENNIAL FREEZING OF ROCKS AND THERMAL CYCLES WITHIN THEM

V. A. Kudryavtsev et al [1970] 8 p Transl. into ENGLISH from Merzlotnye Issled., Geol. Fak., Kafedramerzlotoved. Mosk. Univ., Sb. Statei (Moscow), v. 7, 1967 p 30–37
(AD-711881) Avail: NTIS CSCL 8/12

In a collection of permafrost reports equations were proposed for calculating the depths of the perennial freezing and thawing of layers of rocks, and of the heat exchanges taking place in them. For a calculation of the heat exchanges Q (kcal) in the layer of rocks, pressing through the surface of the Earth during perennial freezing, formulas are given. Author (TAB)

N71-11512# Bureau of Mines, Tuscaloosa, Ala.

MECHANICS OF SEAFLOOR PENETRATION BY AN AXISYMMETRIC TUBE: STATIC PENETRATION STUDIES

Oleg Terichow Nov. 1970 19 p refs
(BM-RI-7451) Avail: NTIS

The penetration of a slender cylindrical tube into a sand bed, simulating seafloor material under the application of a static load is discussed. The factorial experimental design was based on three factors: tube diameter, geometry of penetrating bit, and seawater saturation of sand, all of which were found to be significant in influencing the depth of penetration. The geometry of the penetrating bit, or shoe, is of major significance in the mechanics of penetration and should be considered the most important factor for additional study. Linear regression analyses of the load-penetration data show that the relationship is linear. Author

N71-11513# Bureau of Mines, Denver, Colo.

A METHOD FOR ESTIMATING STRENGTH OF ROCK CONTAINING PLANES OF WEAKNESS

Frank G. Horino and Merlyn L. Ellickson Nov. 1970 35 p refs
(BM-RI-7449) Avail: NTIS

A method of utilizing the Coulomb strength criteria for estimating the strength and stability of pillars and pit slopes containing planes of weakness is presented. It is assumed that the Coulomb theory, as a special case of the Mohr envelope, is a satisfactory first approximation of failure in uniaxial compression or triaxial loading with low lateral loads. Accepting this assumption for brittle materials, an expression for the strength decrease of rock pillars containing a plane of weakness or fracture at any angle of orientation is derived. As few as six samples (three solid cores and three fractured cores at a failure-oriented angle) are required for testing uniaxially and triaxially to statistically determine the coefficients of friction and the shear strengths of both the solid rock and the fracture plane and the range of failure angles of the fracture plane. Interpretation of the data shows that the mean normal stress and maximum shear stress technique of analyzing the data is superior for solid core and that shear and normal stress values using angles of failure should be used for fractured specimens with failure-oriented angles. Author

N71-11514# Royal Greenwich Observatory, Herstmonceux (England). Time and Latitude Service.

GREENWICH TIME REPORT Quarterly Report, Oct. - Dec. 1969

R. v. d. R. Woolley Dec. 1969 15 p
Avail: NTIS

Results of Greenwich time and latitude observations for the period from October to December 1969 are presented. Also included are radio time signals and standard frequency emissions. Author (ESRO)

N71-11515# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

BASIC PROBLEMS OF GENERAL AND REGIONAL GEOCRYOLOGY IN THE NEXT FEW YEARS

V. A. Kudryavtsev 1970 9 p Transl. into ENGLISH from

Merzlotnye Issled. (USSR), no. 7, 1967 p 3–8
(AD-711870) Avail: NTIS CSCL 8/7

The principal problem of the general theoretical and historical geocryology was and remains the problem of studies of the general laws governing the formation and development of frozen layers. In them we must uncover both the thermophysical and geologic-geographical sides of development of the freezing process in their interaction and interrelationship. The logical completion of theoretical studies should be the creation of classification of seasonally frozen layers and those frozen over many years, in which the thermophysical features and thermodynamic conditions of formation and development of the frozen layers should be taken into account. Author (TAB)

N71-11516# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
AREAL VARIABILITY OF SNOW COVER CHARACTERISTICS
T. S. Trifonova 1970 15 p refs Transl. into ENGLISH from Gl. Geofizicheskaya Observ. (Leningrad), no. 130, 1962 p 29–37
(AD-711868) Avail: NTIS CSCL 8/12

The article gives information on the variability in the height and density of snow cover, as well as on the accuracy of determining them in various physical-geographic regions. Author (TAB)

N71-11517# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
THE ALL-UNION CONFERENCE ON PROBLEMS OF AUTOMATION AND MECHANIZATION IN CARTOGRAPHY [VSESOYUZNAYA KONFERENTSIYA PO VOPROSAM AVTOMATIZATSII I MEKHANIZATSII V KARTOGRAFII]
A. A. Pavlov Aug. 1970 8 p refs Transl. into ENGLISH from Vestn. Leningrad. Univ. (USSR), no. 2, Jun. 1967 p 166–167
Conf. held at Moscow, 27–30 Jun. 1967
(AD-711978; ACIC-TC-1621) Avail: NTIS CSCL 8/2

The goal of the conference was to exchange information on theoretical and scientific-experimental research in the area of automation and mechanization of cartographic editorial-preparatory, compiling and publishing work and to work out suggestions on co-ordinating scientific-research activities in the higher educational institutions and organizations in this area of cartographic science and production. Reports devoted to general scientific-technical problems are discussed. Author (TAB)

N71-11518# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
COMPUTING THE FORMATION OF ICE INTERLAYERS IN FREEZING MOIST SOIL
V. G. Melamed 1970 13 p refs Transl. into ENGLISH from Merzlotnye Issled. (USSR), no. 6, 1966 p 28–37
(AD-711874) Avail: NTIS CSCL 8/12

An equation is derived which represents an essentially new condition of ice formation in the soils penetrated by frost, establishing the nature of the freezing, linking the dynamics of the temperature fields in both zones and the rate of the freezing fronts advance with the dynamics of a moisture field. Author (TAB)

N71-11525# Royal Greenwich Observatory, Herstmonceux (England). Time and Latitude Service.
GREENWICH TIME REPORT Quarterly Report, Jul.–Sep. 1969
R. v. d. R. Woolley Sep. 1969 14 p
Avail: NTIS

Results of Greenwich time and latitude observations for period from July to September 1969 are presented. Also included are radio time signals and standard frequency emissions. Author (ESRO)

N71-11538# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
THE EARTH'S CRUST AND MANTLE
R. M. Demenitskaya Aug. 1970 399 p refs Transl. into ENGLISH of the book "Kora i Mantiya Zemli" Moscow, Nedra, 1967 p 1–280
(AD-712106; ACIC-TC-1558) Avail: NTIS CSCL 8/7

The translation is a summary of complex data on the earths crust and upper mantle. In the examination of the data on the various regions of the terrestrial globe (characteristics of the gravity, magnetic, seismic, thermal and electric fields of the earth) and the comparison between them and the structure of the crust, the author reveals the specific features of the different geological structures and determines the diagnostic significance of the geophysical data. Much attention is given to the crustal structure of the oceanic areas. A description of the general characteristics of the relief and the physical properties of the upper mantle is given in the last section of the book, where the physical map of the upper mantle is given in the last section of the book, where the physical map of the upper mantle is presented. In conclusion, a review is given of the projects of ultradeep scientific boring in the Pacific ocean, territory of the USSR, Japan and Canada. Author (TAB)

N71-11539# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
THE USE OF AERIAL PHOTOGRAPHY IN GEOCRYOLOGICAL SURVEYS
1970 7 p refs Transl. into ENGLISH from the Russian
(AD-711926) Avail: NTIS CSCL 8/2

Advantages of the use of aerial photographic methods in geocryological research are given. TAB

N71-11540# Koln Univ. (West Germany). Inst. fuer Geophysik und Meteorologie.
OZONE RADIOSONDES FOR THE DETERMINATION OF THE VERTICAL ATMOSPHERIC OZONE DISTRIBUTION [OZONRADIOSONDEN ZUR BESTIMMUNG DER VERTIKALEN ATMOSPHAERISCHEN OZONVERTEILUNG]
F. Piscalar Mar. 1969 80 p refs In GERMAN Sponsored in part by Deut. Forschungsgemeinschaft *Its* Mitt. No. 8
Avail: NTIS

The improvement of the recoverable Paetzold-Regener sounding ozonometer used in balloon sounding is described. A transistor amplifier replaces that of the vacuum tube, a new sensitivity switch has been introduced and the mechanical design has been changed. The measuring speed is increased and the evaluation and correction of the measuring values are described. Author (ESRO)

N71-11541# Technical Univ. of Denmark, Lyngby. Ionosphere Lab.
GM OBSERVATIONS OF AURORAL PARTICLES AND GROUND OBSERVATIONS DURING THE FEBRUARY 25th SOLAR EVENT
Peter Stauning, Gunnar Skovli (Norweg. Defence Res. Estab., Kjeller), and Axel Bahnsen (Danish Space Res. Inst.) 31 Oct. 1969 17 p refs Presented at the 3d ESLAB/ESRIN Symp., Noordwijk, Neth., 16–19 Sep. 1969
(R-17) Avail: NTIS

The S71D experiment on board the polar orbiting ESRO 1 satellite is an array of Geiger counters. The experiment is primarily devoted to the study of fast variations and fine structure in the intensities and in the angular spectra of energetic (greater than 40 keV) auroral electrons. The experiment is briefly described, and some preliminary results from measurements made during the February 25th solar event are presented. Author (ESRO)

N71-11542# Groupe de Recherches Ionospheriques, Issy-les-Moulineaux (France).
STUDY OF THE LINK BETWEEN TOPSIDE AND BOTTOM

SIDE SOUNDINGS PERFORMED AT OUAGADOUGOU [ETUDE DU RACCORDEMENT DE SONDAGES EN CONTRE-HAUT ET EN CONTRE-BAS EFFECTUES A OUAGADOUGOU]
R. Bernard and C. Taieb 15 Apr. 1970 34 p refs In FRENCH
(Contract CNES-68-216)
(GRI/NT/78) Avail: NTIS

Many ionospheric soundings are being carried out from ground stations to evaluate the ionized layer and its variations as functions of geophysical parameters, especially the magnetic field. For these studies it is important to know how topside ionograms and soundings from the bottom are joined. Ionograms made at Ouagadougou (Upper Volta) are analyzed in this respect. ESRO

N71-11547# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
MARINE HYDROCHEMISTRY
L. K. Blinov 1970 78 p refs Transl. into ENGLISH from Tr. Gos. Okeanogr. Inst. (Moscow), v. 83, 1965 p 5–55
(AD-711925) Avail: NTIS CSCL 8/10

The report consists of two chapters of an unfinished book, Khimiya Morya (Marine Chemistry). It discusses the salt composition of ocean waters, salinity and the composition of salts in sea ice in relation to processes of phase transitions and formation of ice from sea water as a complex solution. Author (TAB)

N71-11562# Arctic Inst. of North America, Washington, D.C.
PERMAFROST EROSION ALONG THE BEAUFORT SEA COAST
Robert I. Lewellen (Denver Univ.) Mar. 1970 34 p refs
(Contract N00014-70-A-0219-0001)
(AD-711344) Avail: NTIS CSCL 8/12

The purpose of the report is to illustrate and focus attention on the permafrost erosion along the Beaufort Sea coast of Northern Alaska. The thermal erosion of permafrost along the coast results in shore line recessions as great as ten meters (33 feet) per year. The recession is caused by wave action and air temperatures thawing the frozen sediments. The two areas which are discussed in detail are Elson Lagoon and Flaxman Island. Elson Lagoon is located south of Point Barrow, Alaska. Flaxman Island is adjacent to the Prudhoe Bay oil development activity. The receding shore lines must be considered before a logical definition of this region is possible. Author (TAB)

N71-11594# Radio Corp. of America, Princeton, N.J. Astro Electronics Div.
GROUND DATA-HANDLING SYSTEM STUDY FOR THE EARTH RESOURCES OBSERVATION SATELLITE. PHASE 2: USER DATA PROCESSING REQUIREMENTS Final Report
H. Gurk, P. Wood, and C. Smith 20 Nov. 1969 132 p refs
(Contract DI-14-08-0001-11915)
(PB-193666; AED-R-3515) Avail: NTIS CSCL 09B

The ground data handling aspects of the EROS Program are considered from the users point of view. The type of processing that would be most useful to the user for their analysis and interpretation, the techniques that are currently available or can be developed to accomplish this processing is discussed. The data needs of two potential EROS-data users, the Tennessee Valley Authority and the Desert Research Institute of the University of Nevada, were investigated in detail. Author (USGRDR)

N71-11680# Hawaii Univ., Honolulu. Water Resources Research Center.
AEROMAGNETIC, GRAVITY, AND ELECTRICAL RESISTIVITY EXPLORATION BETWEEN PAHALA AND PUNALUU, HAWAII
William M. Adams, Surendra P. Mathur, and Richie D. Huber Feb. 1970 58 p refs
(Contract DI-14-01-0001-0494)
(PB-192807; HIG-WRRC-4; W70-08154; TR-28; Rept-3) Avail: NTIS CSCL 08H

Aeromagnetic, electrical resistivity, and gravity surveys were conducted in the area between Pahala and Punaluu, Hawaii to delineate barriers to ground-water movement. The geophysical data are interpreted and compared to determine the sectors of relatively low gradient ground water between the barriers. In the Pahala area, two barriers to lateral ground-water movement have been located: the Kolea barrier, which trends roughly east to west, and the second barrier, associated with a 'crack' used as the Pahala dump, designated by this study as the Pahala dump barrier. The Pahala dump barrier definitely appears to terminate at the Kolea barrier. These barriers are defined by magnetic, gravity, and electrical sounding and profiling observations. USGRDR

N71-11684*# Scripta Technica, Inc., Washington, D.C.
ELECTRICAL CONDUCTIVITY OF ROCKS OF KAZAKHSTAN AT HIGH TEMPERATURES [ELEKTROPROVODNOST GORNYKH POROD KAZAKHSTANA PRI VYSOKIKH TEMPERATURAKH]
E. I. Parkhomenko et al NASA Oct. 1970 19 p refs Transl. into ENGLISH from Tr. Inst. Fiz. Zemli Akad. Nauk SSSR (Moscow), v. 204, no. 37, 1966 p 180–191
(Contract NASw-2036)
(NASA-TT-F-13213) Avail: NTIS CSCL 08G

The electrical conductivity of rocks taken in Kazakhstan is studied under laboratory conditions at high temperatures. Results are presented separately in tabular and graphic form for various types of rocks. Electrical conductivity varies with mineralogical and petrographic characteristics of the rock, as well as with moisture content, since moisture makes up the main source of initial current carriers. Author

N71-11695# Michigan Univ., Ann Arbor. Dept. of Mechanical Engineering.
STUDIES OF STRATIFIED FLOWS, ROTATING FLUIDS, AND FLUID-MECHANICS PROBLEMS RELATED TO GEOPHYSICAL PHENOMENA Final Report, 1 Mar. 1966 – 30 Jun. 1970
Chia-Shun Yih Aug. 1970 25 p refs
(Grant DA-ARO(D)-31-124-G717)
(AD-712322; Rept-07891) Avail: NTIS CSCL 20/4

The general objectives of the project are to deepen the understanding of the mechanics of a stratified and of a rotating fluid, to broaden the knowledge in that field, and to apply the results to the explanation of geophysical phenomena which occur in the atmosphere, in the oceans, and in the rivers, or to the solving of engineering problems. A review is provided of research accomplishments, doctoral dissertations completed, and publications of the chief investigator. Author (TAB)

N71-11700# Weapons Research Establishment, Farnborough (England).
A SEASONAL MODEL FOR DENSITY IN THE ALTITUDE RANGE 45 TO 90 km AT WOOMERA (31 DEG S)
R. J. Curnow Jun. 1970 33 p refs
(WRE-TN-HSA-174) Avail: NTIS

A seasonal density model for the height range 45 to 90km at 31 deg S is presented. This is based on between twenty-one and twenty-eight falling sphere experiments – depending on the height level – spread over three years. This model is compared to the CIRA 1965 model for 30 deg S. Author

N71-11753# Army Engineer Topographic Labs., Fort Belvoir, Va.
A RELATION BETWEEN THE SPECTRUM OF SURFACE SLOPES AND THE SPECTRUM OF SURFACE ELEVATIONS

AND ITS USEFULNESS IN THE THEORY OF ELECTROMAGNETIC WAVE SCATTERING FROM ROUGH SURFACES

Richard A. Hevenor Jul. 1970 13 p
(AD-711537; ETL-RN-70-2) Avail: NTIS CSCL 20/14

The purpose of this research note is to show that a simple relation exists between the spectrum of surface elevations and the spectrum of surface slopes. This relation is useful when working on the problem of electromagnetic wave scattering from rough surfaces. When using the small perturbation theory to compute scattered fields from a rough surface, both the spectrum of surface elevations and the spectrum of surface slopes can appear in the final equations. The spectrum of the surface elevations is easy to work with and can be determined from measurements made on the surface. The spectrum of the surface slopes, however, is more difficult to work with. It would be very beneficial if a relation between the two spectrums could be obtained. Author (TAB)

N71-11863# International Institute for Aerial Survey and Earth Sciences, Delft (Netherlands).

THE MORPHO-DYNAMICS OF THE CRATI RIVER BASIN, CALABRIA, ITALY

J. L. van Genderen Jan. 1970 47 p refs
(B-56) Avail: NTIS

This paper discusses the processes acting on the various landforms present in the Crati river basin. The mechanisms of the many processes of erosion and mass-movements are treated, as well as the resultant forms. Once the causes of erosion and landsliding have been explained, the conservation practices used to prevent the active erosion and landslides present are critically studied for their effectiveness. The role of photo-interpretation in identifying and mapping landslides, potential landslides, and erosional features is also treated. Author

N71-11864# Ionospharen-Institut Breisach (West Germany).

IONOSPHERE DATA, VERTICAL-ECHO-SOUNDING: FREIBURG, URSI-CODE 131, AUGUST 1970 [IONOSPHAEREN-DATEN, VERTIKAL-ECHO-LOTUNG: FREIBURG, URSI-CODE 131, AUGUST 1970]

Aug. 1970 44 p In GERMAN and ENGLISH
(Rept-290-F) Avail: NTIS

Ionospheric data from vertical echo soundings of the E and F regions are presented. Data tables contain median and daily measurements performed during August, 1970. Transl. by G.G.

N71-11865# Ionospharen-Institut Breisach (West Germany).

IONOSPHERE DATA, ABSORPTION MEASUREMENTS: FREIBURG, URSI-CODE 131, JANUARY-JULY 1970 [IONOSPHAEREN-DATEN, ABSORPTIONS-MESSUNGEN: FREIBURG URSI-CODE 131, JANUAR-JULI 1970]

1970 15 p refs In GERMAN
Avail: NTIS

Automatic registered ionospheric echo absorption data for eight differing frequencies are presented. Measurements lasted 3 minutes and were repeated eight times during half hourly intervals. Data tables contain median and daily absorption measurements obtained during the period January through July, 1970. Transl. by G.G.

N71-11906*# National Center for Atmospheric Research, Boulder, Colo.

SUPERPRESSURE BALLOON FLIGHTS FROM CHRISTCHURCH, NEW ZEALAND, JULY 1968-DECEMBER 1969

Vincent E. Lally, A. Brewster Rickel, and Marcel A. Verstraete May 1970 109 p ref Sponsored in part by NASA, ESSA, and NSF
(NASA-CR-111410; NCAR-TN-48) Avail: NTIS CSCL 04A

Flight summaries and analyses of phase 3 GHOST balloon flights from 1 July 1968 to 31 December 1969. These flights were launched from Christchurch, New Zealand, and from an auxiliary site in the South Pacific. Superpressure balloon flights below the freezing level and flights of balloons equipped with strain gages are discussed. Author

N71-11907*# Scientific Translation Service, Santa Barbara, Calif.

RESULTS OF DIAGNOSTICS OF CARBON ELEMENTS FORMED IN VARIOUS GEOLOGICAL PROCESSES [REZULTATY DIAGNOSTIKI UGLERODISTYKH VESHCHESTV OBRAXUYUSHCHIKHSYA PRI RAZLICHNYKH GEOLOGICHESKIKH PROTSESSAKH]

V. N. Florovskaya Washington NASA Nov. 1970 10 p Transl. into ENGLISH of the book "Abiogenez i Nachalnyye Stadii Evolyutsii Zhizni" Moscow, Nauka Press, 1968 p 34-40
(Contract NASw-2035)
(NASA-TT-F-13184) Avail: NTIS CSCL 08G

Carbon tracing of various mineral-forming processes is described. Mineral samples in various stages of formation were taken at various locations in the USSR. The geological development of several minerals was traced. Author

N71-11912# Centre National de la Recherche Scientifique, Bellevue (France). Lab. D'Aerothermique.

EXPERIMENTAL METHOD OF CLASSIFYING SOILS ACCORDING TO THEIR DEGREE OF FREEZING [METHODE EXPERIMENTALE DE CLASSEMENT DES SOLS SELON LEUR DEGRE DE GELIVITE]

J. Aguirre-Puente and A. Dupas Jun. 1970 53 p refs In FRENCH
(Rept-70-5) Avail: NTIS

An apparatus is described which allows several samples of soil to be observed simultaneously. The freezing process is discussed and different soil classes, based on this method, are given. The physical, structural, and chemical properties are included in the discussion. Transl. by E.H.W.

N71-11939*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

LOW DEGREE RESONANT GEOPOTENTIAL COEFFICIENTS FROM EIGHT 24-HOUR SATELLITES

C. A. Wagner Oct. 1970 43 p refs Submitted for publication
(NASA-TM-X-65382; X-552-70-402) Avail: NTIS CSCL 04A

The most extensive tracking data base on 24 hour satellites has been analyzed for resonant geopotential effects in the period 1963-1969. The observations used consisted of 279 sets of mean Kepler elements in 21 free drift arcs of eight satellites, each arc between 7 weeks and 3-1/2 years in length. Current geopotential solutions from the Smithsonian Astrophysical Observatory (SAO) which do not use the 24-hour data are shown to recover most of these observations almost as well as in solutions using this data. However, since the longest arcs are poorly recovered with the best Smithsonian field, an improved resonant geopotential is desirable. Therefore, a new solution is derived which combines the best available low degree Smithsonian coefficients with the 24 hour data. This solution is virtually indistinguishable from the best fitting solution from only 24 hour data. Author

N71-11940# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

ACOUSTICAL CHARACTERISTICS OF ICE UNDER STATIC PRESSURE

V. V. Bogorodskii et al 1970 12 p Transl. into ENGLISH from Akust. Zh. (Moscow), v. 13, no. 1, 1965 p 18-22
(AD-711867) Avail: NTIS CSCL 8/12

Measurements were made of the speed of longitudinal ultrasonic waves in fresh polycrystalline ice at variable static pressure. TAB

N71-11947# Air Force Cambridge Research Labs., Bedford, Mass. Aeronomy Lab.

EXTREME TEMPERATURE, PRESSURE, AND DENSITY BETWEEN 30 AND 80 km

Allen E. Cole 12 Aug. 1970 38 p refs *Its* Environ. Res. Papers No. 330
(AD-712019; AFCRL-70-0462) Avail: NTIS CSCL 4/1

The distributions of temperatures, pressures, and densities derived from rocket observations between 30 and 80 km are examined with special attention given to extremes. Estimates are provided of the medians and values that are exceeded 1 and 10 percent of the time at various latitudes when the monthly means are highest, and of the 99- and 90-percent extremes and medians when monthly means are lowest. The high and low extreme values of temperature, pressure, and density at these levels occur near the pole. Densities are highest in summer when the circulation pattern is dominated by an anticyclone centered over the pole. Lowest values occur in winter and are associated with the polar cyclone that is normally centered off the east coast of northern Greenland. Author (TAB)

N71-11954# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

PRELIMINARY REPORTS ON THE USE OF ELECTROMETRY IN STUDYING THE MOVEMENT OF GLACIERS

B. A. Borovinskii et al 1970 10 p refs Transl. into ENGLISH from Vest. Akad. Nauk Kaz. SSR (Alma-Ata), v. 172, no. 7, 1959 45–50
(AD-711911) Avail: NTIS CSCL 8/12

The first measurements of the surface rate of movement of glaciers were made 200 years ago. Extensive data on the movement of glaciers have now been collected on a planetary scale, but in the overwhelming majority of cases it characterizes with sufficient accuracy only the surface rates for different parts of glaciers. In determining the rate of ice movement within a glacier when studying the electric field created by an electrode in a borehole it is recommended that the potential gradient be measured, since this is most sensitive to field change. Since the conductivity of an electrode lowered into the ice exceeds by many times the conductivity of the surrounding rock-ice medium, the field will be created for the most part by the electrode itself and the potential gradient can be computed using a formula proposed. Author (TAB)

N71-11956# Eidgenossische Technische Hochschule, Zurich (Switzerland). Lab. fuer Atmosphaerenphysik.

REGULAR OZONE OBSERVATION AT THALWIL, SWITZERLAND AND AT BOULDER, COLORADO

H. U. Duetsch, W. Zuellig, and Ch. Ling Jan. 1970 279 p refs
(LAPETH-1) Avail: NTIS

Soundings with the electrochemical ozone sonde from Zurich Switzerland are compared with a series made at Boulder, Colo. A number of soundings demonstrate the transfer of air from the stratosphere into the troposphere either by ozone increase just below the (conventional) tropopause or by already showing a detached layer at a lower elevation. Comparison of ozone and temperature soundings demonstrate clearly that ozone is below 20 km a more conservative property of an air parcel than potential temperature. The often very complicated vertical structure of the ozone distribution results apparently from the effects of large scale quasi horizontal exchange processes which may partly have occured many days or weeks earlier. A full understanding of the quite complex circulation could only be obtained from observations in a much better network than is available at present. Author

N71-11962# RAND Corp., Santa Monica, Calif.

STUDIES IN CLIMATE DYNAMICS FOR ENVIRONMENTAL SECURITY: A CALIBRATED ANALYTICAL MODEL FOR THE THERMOHALINE AND WIND-DRIVEN CIRCULATION IN THE INTERIOR OF A SUBTROPICAL OCEAN

R. C. Alexander Sep. 1970 34 p refs
(Contract DAHC15-67-C-0141; ARPA Order 189-1)
(AD-712108; R-505-ARPA) Avail: NTIS CSCL 8/3

The report contains sections on scaling and calibration, variation of the wind stress parameter to check the calibrated model, and variation of the vertical thermal diffusion parameter. Results are discussed in terms of heat balance components. The temperature distributions calculated are in qualitative agreement with the more detailed numerical model of Bryan and Cox. An increasingly pronounced subtropical high temperature pattern with an increasing wind stress parameter is a feature common to both models. A new result is the lack of appreciable differences in temperature distributions with or without vertical thermal diffusion. Author (TAB)

N71-11963# Michigan Univ., Ann Arbor. Geophysics Lab.

DIGITAL SIMULATION OF SEISMIC RAYS, SUPPLEMENT Final Report, 1 Jun. 1966 – 30 May 1970

P. L. Jackson Aug. 1970 94 p refs Supplement to final report
(Contract AF 49(638)-1759; ARPA Order 292; Proj. Vela Uniform)
(AD-712092; AFOSR-70-2391TR; Rept-8071-33-F;Suppl) Avail: NTIS CSCL 8/11

The problem of complicated seismic velocity distributions was therefore investigated in terms of the most appropriate use of the digital computer. For this investigation a velocity field was set up, and the propagation computations made for short segments of rays within this field. Total travel times are found by adding the travel times of connected ray segments. Essentially, the nature of propagation was duplicated on the computer, in that, at the location of each segment along the path of propagation, the initial condition and effect of the surroundings determine the succeeding direction of the following segment. Author (TAB)

N71-11964*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.

IONOSPHERIC RESEARCH: DIURNAL VARIATION OF THE NEUTRAL TEMPERATURE PROFILE AT ARECIBO FROM INCOHERENT SCATTER MEASUREMENTS AND ITS RELEVANCE TO THE 1400 HOUR DENSITY MAXIMUM

W. E. Swartz 15 Oct. 1970 64 p refs
(Grant NGL-39-009-003)
(NASA-CR-111416; SR-364) Avail: NTIS CSCL 04A

Series of high resolution electron and ion temperature and electron density measurements at Arecibo were used to derive profiles of the neutral temperature from 116 km to 400 km throughout the day. In this technique, use was made of least square fitting to calculate a smooth temperature profile and a neutral atmospheric model. Two methods were employed to calculate the density profile. The first assumes that the density at 120 km is known and solves for the diffusion equilibrium model that best fits the data. The second method requires only the assumption of the relative densities of the neutral constituents at the lower boundary but has a somewhat higher experimental variance. It is shown that density and temperature do not in general peak at the same time as indicated by the current atmospheric models. Neutral temperatures derived from incoherent sounding have indicated a temperature maximum near 1600 hours. It is now suggested that these two phenomena may be self consistent when the entire temperature profile affecting the neutral density is considered. Author

N71-11974*# South Dakota State Univ., Brookings. Remote Sensing Inst.

REMOTE SENSING FOR DETECTION OF SOIL LIMITATIONS IN AGRICULTURAL AREAS Quarterly Report, 1 Apr. – 1 Jul. 1970

Jun. 1970 22 p
(NASA Order W-12996)
(NASA-CR-111423) Avail: NTIS CSCL 02D

Remote sensing methods, aerial reconnaissance, special cameras, and an infrared imager, were used to determine proper land use and land use limitations on a potential irrigation project. Multispectral photographs were used to establish pattern recognition techniques for identifying clay pan conditions and for classifying fields in land use patterns. Rapid scan, automatic interpretation techniques were developed from analog data and multispectral transparencies. E.H.W.

N71-11976*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

SECOND ANNUAL EARTH RESOURCES AIRCRAFT PROGRAM STATUS REVIEW. VOLUME 2: AGRICULTURE/FORESTRY, AND SENSOR STUDIES

1969 479 p refs Conf. held at Houston, Tex., 16 18 Sep. 1969
(NASA-TM-X-66484) Avail: NTIS CSCL 08F

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14. GROUND TRUTH/SENSOR CORRELATION P. Chapman, J. Quade, P. Brennan (Nev. Univ.), and J. C. Blinn, III (JPL) 28 p refs (See N71-11990 02-14)
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17. EXPERIMENTAL RESULTS IN THE REMOTE SENSING OF GASES FROM HIGH ALTITUDES A. R. Barringer and J. H. Davies (Barringer Res., Ltd., Dowagiac, Mich.) 31 p (See N71-11993 02-14)

N71-11977*# California Univ., Berkeley. Forestry Remote Sensing Lab.

THE INVENTORY OF VEGETATION RESOURCES: USER REQUIREMENTS VERSUS REMOTE SENSING CAPABILITIES

Robert N. Colwell *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 2 1969 71 p refs (See N71-11976 02-13)
Avail: NTIS CSCL 08F

The different approaches which may be applied in relating user requirements with remote sensing capabilities are discussed. Examples are given of agricultural and forest resources requirements to illustrate both the broad and narrow viewpoints of user requirements. Two kinds of photography are compared to evaluate the remote sensing capabilities provided by aircraft and spacecraft. The first type is multiband space photography of various earth resource test sites in the U. S. taken from an altitude of about 110 nautical miles by Apollo 9 astronauts, and the second type is multiband aerial photography taken of the same sites from an altitude of approximately 70,000 feet at the same time of the Apollo 9 overflight, and at monthly intervals afterwards. The studies show that, while one type of observation may provide more information than another, a multistage sampling technique which employs spacecraft, aircraft, and ground observations is the most suitable for operational earth resources surveys of the future. R.B.

N71-11978*# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.

MULTI-STAGE SAMPLING OF FOREST RESOURCES BY USING SPACE PHOTOGRAPHY

Philip G. Langley, Robert C. Aldrich, and Robert C. Heller *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 2 1969 21 p refs (See N71-11976 02-13)
Avail: NTIS CSCL 02F

The exploration of earth resources from space can lead to the development of a dynamic forest resources information system based on imagery obtained from remote sensors and newly developed sampling techniques. A pilot timber inventory was conducted on 10 million acres of land in Arkansas, Georgia, Louisiana, and Mississippi by using photography taken from the Apollo 9 spacecraft. To increase sampling efficiency, the photos were used 1/60,000 scale Plarioid, 1/12,000 scale 70 mm, and 1/2,000 scale 70 mm color aerial photos in a stratified five-stage probability sampling design. This design yields unbiased estimates that are independent of the quality of the imagery. Sampling errors are, however, inversely related to the quality of the photo data. The best results were obtained on 5 million acres in the Mississippi Valley area, where a 58 percent reduction in sampling error was attributed to information obtained from the Apollo 9 photography. The sampling design can be used to survey agricultural as well as forestry resources from space. Author

N71-11979*# Oregon State Univ., Corvallis.

RANGE RESOURCE INVENTORY FROM SPACE AND SUPPORTING AIRCRAFT PHOTOGRAPHY

Charles E. Poulton, Richard S. Driscoll (Rocky Mt. Forest and Range Expt. Station), and Barry J. Schrumpf *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 2 1969 28 p (See N71-11976 02-13)
Avail: NTIS CSCL 08F

Interim results and progress on the use of space and aircraft photography for range resource inventories are reviewed. Preliminary guidelines on vegetational mapping and a legend concept by which the information can be conveyed to the user are presented. A multistage sampling procedure to obtain data needed for detailed interpretation of space photography is explained. The same procedure permits explanation of the makeup of the vegetational units interpreted from space photography. The potential contribution of multiseasonal photography in photointerpretation is discussed. Author

N71-11980*# California Univ., Berkeley. School of Forestry and Conservation.

MULTIPLE RESOURCE INVENTORY ON SPACE AND HIGH-ALTITUDE PHOTOGRAPHY

Lawrence R. Pettinger *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 2 1969 19 p ref (See N71-11976 02-13)
Avail: NTIS CSCL 08F

The potential for making broad land use maps and earth resource surveys was evaluated using Apollo 9 space photographs, and small-scale photographs obtained by high altitude aircraft. It is shown that several different photointerpretation procedures can be integrated to extract information from space and aerial photographs on several resources within a single geographic area. Specific techniques are discussed for the inventory of agricultural, range, geologic, and hydrologic resources. In each case, a particular set of interpretation procedures were chosen depending on the nature of the resource. Color composite images, both optical and electrical, were prepared to enhance differences between crop types. Interpretation tests are described that are used to evaluate how well crop types can be identified on the various space and sequential high altitude photographs, as well as color composite images made from these photographs. Author

N71-11981*# Agricultural Research Service, Weslaco, Tex. Soil and Water Conservation Research Div.

INTERACTION OF ELECTROMAGNETIC ENERGY WITH AGRICULTURAL CROPS

Craig L. Wiegand, Harold W. Gausman, William A. Allen, and Ross W. Leamer *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 2 1969 14 p refs (See N71-11976 02-13)
(NASA Order R-09-038-002)
Avail: NTIS CSCL 08F

The remote sensing research program of studying the interaction of electromagnetic radiation with plants, soils, and water, and wavelengths and procedures for discriminating agricultural crops is discussed. Absolute spectrophotometric data indicate that over the wavelength interval 500 to 1400 nanometers (nm), leaf signature is mainly a function of leaf pigments and structure, and growth stress conditions cause a rounding of the reflectance plateau in the wavelength interval 750 to 900 nm. The discrimination of crop species based on infinite reflectance was very successful for the wavelength interval 1300 to 2200 nm. Two pattern recognition techniques, the minimum distance to the mean and statistical pattern recognition, were investigated. Advances in photographic transparency quantitization and analysis are illustrated using Apollo 9 SO-65 experiment and aircraft imagery. The techniques involve use of optical density differences among densities measured with different bandpass filters in the light beam and no filter in the light beam. The procedures have been computerized for crop and soil condition discrimination. Author

N71-11982*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

APPLICATION OF AUTOMATIC RECOGNITION TECHNIQUES TO EARTH RESOURCES

R. B. MacDonald *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 2 1969 27 p refs (See N71-11976 02-13)
Avail: NTIS CSCL 08F

A multidisciplinary program designed to explore critical problem areas in agricultural applications is discussed. The program is organized into research areas of biogeophysics, measurements, data processing, requirements and applications, and aerospace systems analysis. Biogeophysical research teams are organized to deal with problems of vegetation, soils, and water. The primary objectives of the research are to correlate remotely sensed measurements to physical and chemical properties of radiating scenes. The results of research to apply advanced remote sensing and processing techniques to agricultural situation are discussed. Author

N71-11985*# Stanford Univ., Calif.

AIRBORNE INFRARED STUDY OF IGNEOUS ROCKS IN SONORA PASS TEST SITE

I. A. Kilinc and R. J. P. Lyon *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 2 1969 19 p refs (See N71-11976 02-13)
(Contract NAS9-7313)
Avail: NTIS CSCL 08G

An aircraft equipped with an infrared pallet consisting of a Lockheed airborne rapid scan IR spectrometer, a Block IR radiometer, a boresight camera, a PRT 5 radiometer, and two RC8 cameras was flown over Sonora Pass and Mono Lake test sites during the period August 27 – 28, 1968. The mission was flown to obtain airborne infrared emission spectra in the 6.76 to 13.33 micron wavelength band, and to discriminate among rock types on the basis of their infrared emission spectra by use of various data processing techniques. The primary objective of the mission was to test the feasibility of using a three-instrument IR pallet together with the data recording system and to identify the various rock types in selected geologic target areas. The results indicate that certain types of igneous rocks in the test site were identified and contacts between them were determined with about 90% success. However, the airborne infrared emissivity study is limited by the high cost of data collection and processing, by gathering information only along a given flight line, and by dependency of rock type identification on the training spectra taken from the area under study. Author

N71-11986*# Michigan Univ., Ann Arbor.

NASA SUPPORTED REMOTE SENSING ACTIVITIES AT THE UNIVERSITY OF MICHIGAN WILLOW RUN LABORATORIES Annual Report, Sep. 1969

M. R. Holter *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 2 1969 36 p ref (See N71-11976 02-13)
Avail: NTIS CSCL 08F

Research progress is reported on remote sensor data processing, interpretation, and utilization. The data is derived from remote sensing in the ultraviolet, visible, infrared, passive microwave, and radar portions of the spectrum, as well as acoustic and seismic techniques. Illustrative examples are given of recognizing wheat crops at different altitudes and times of the year, of reducing the effects of cloud shadows by preprocessing techniques, and participation in the SO-65 experiment over the Imperial Valley in California. It is recommended that sampling at frequent intervals during diurnal and seasonal cycles be conducted, with more adequate ground truth and calibration, at least two years prior to ERTS operation. R.B.

N71-11994*# Department of Agriculture, Washington, D.C.

[SOIL PHOTOGRAPHIC MAPPING] Periodic Report, 1 Jan. – 30 Jun. 1970

30 Jun. 1970 16 p
(NASA Order W-12996)
(NASA-CR-111418) Avail: NTIS CSCL 08E

Pattern recognition and soil mapping studies pertaining to soil classification are discussed. Reports from the photography laboratory, APT satellite tracking station, and mission records are included. Development of an automatic pattern recognition system that is useful for analysis and feature development, feature selection, and classification of remote sensing data is reported. The usefulness is determined of spot density readings made on Ektachrome infrared film for the classification of crops. Author

N71-12011# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
EARTHWORK UNDER WINTER CONDITIONS
1970 174 p refs Transl. into ENGLISH of the publ. 'Proizvodstvo Zemlyankh Rabot v Zimnikh Usloviyakh' Moscow, Gosstroiizdat., 1961 p 1-100
(AD-711890) Avail: NTIS CSCL 8/13

The manual gives information on the physical and mechanical properties of frozen ground, methods for their loosening and thawing and methods for safeguarding the ground from freezing. Also given are the characteristics of earthwork in winter (in-applicable to areas of permafrost) and the technical and economic indices for the working of frozen ground by different methods. Author (TAB)

N71-12017*# Translation Consultants, Ltd., Arlington, Va.
GEOTHERMAL INVESTIGATIONS AS ONE OF THE METHODS FOR DETERMINING THE SUBSURFACE STRUCTURE OF PETROLIFEROUS AND GAS BEARING REGIONS [GEOTERMICHESKIYE ISSLEDOVANIYA KAK ODIN IZ METODOV VYYAVLENIYA GLUBINNOGO STROYENIYA NEFTEGAZONOSNYKH RAYONOV]
S. T. Ovnatanov et al Washington NASA Dec. 1970 11 p refs Transl. into ENGLISH from Neftegaz. Geol. i Geofiz., Nauchn.-Tekhn. Sb. (Moscow), no. 12, 1969 p23-27
(Contract NASw-2038)
(NASA-TT-F-13392) Avail: NTIS CSCL 08D

Investigations to determine the petroleum and gas bearing potential in certain regions of the USSR are reported. Since geophysical criteria often cannot determine structural complexities beneath the surface, geothermal methods were pursued. Author

N71-12028# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
THE EFFECT OF THE ICE-SEPARATION CURVE ON THE THAWING OF GROUND
V. G. Melamed [1970] 7 p refs Transl. into ENGLISH from Merzlotnye Issled., Geol. Fak. Kafedra Merzlotoved. Mosk. Univ., Sb. Statei (Moscow), v. 7, 1967 p 44-49
(AD-711887) Avail: NTIS CSCL 8/12

In a solution of the problem concerning the thawing (melting) in finely-dispersed media, of considerable significance, in addition to the phase transformations of the free moisture, occurring momentarily at the mobile boundary of the phases interface, is the consideration of the phase transitions of the bound water, occurring in the spectrum of the temperatures. However, the solution of the Stefan problem in this context becomes abruptly complicated, since within each zone, the differential equations become nonlinear (the coefficients of heat conduction and heat capacity depend on the temperature). In addition, it is necessary to take into account the continually distributed (through the space of the frozen ground) internal sources of heat, the intensity of which depends on the unknown function. Author (TAB)

N71-12034# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
ON THE MECHANISM OF NIVAL PROCESSES
B. P. Lyubimov 1970 15 p refs Transl. into ENGLISH from Podzemn. Led (USSR), Part 3, No. 3, 1967 p 158-175
(AD-711879) Avail: NTIS CSCL 8/12

A description of nival processes is presented. The process is defined as the geomorphological process of the formation of corrie-like recesses on the slopes in the places of occurrence of firns as a result of the disruption of rocks along the edges of the firns under the effect of physical erosion and the subsequent removal of the material with the aid of fine streams of meltwater. Freezing phenomena are the bases of the nival processes. The freezing phenomena, connected with the special position of the bodies of the firns and glaciers, and with the special freezing conditions near them, comprise the essential specific moment of nivation, distinguishing it from the other natural phenomena. Author

N71-12055# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
ON BOUGUER ANOMALIES IN THE OCEAN [OB ANOMALIYAKH BUGE NA OKEANAKH]
N. P. Grushinskii et al Apr. 1970 9 p Transl. into ENGLISH from Akad. Nauk SSSR Dok. (USSR), v. 184, no. 2, 1969 p 331-333
(AD-711979; ACIC-TC-1634) Avail: NTIS CSCL 8/5

The paper deals with the problems of the accepted interpretation of the Bouguer reduction for the sea. The only thing which to some extent could justify the introduction of the Bouguer reduction at sea is a certain smoothing out of the effect exerted by the relief forms of the oceanic bottom in each local area. But the smoothing is made in an unfavorable manner, because then a large artificial regional background is created. The introduction of the Bouguer reduction at sea is associated with the problem of specific processing of the material for its various types of interpretation. Bouguer anomalies for oceanic regions, formed by filling up the ocean to the rocks of medium density, without taking into account the correction for the relief of the oceanic bottom, can be distorted by tens of milligals. Author (TAB)

N71-12056# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
EXPERIMENTAL DETERMINATION OF FROST HEAVE FORCES IN THE GROUND
S. S. Vyalov et al 1970 24 p refs Transl. into ENGLISH from Akad. Nauk SSSR Inst. Merzlotovedeniya Tr. (USSR), v. 14 1958 Prepared by Aztec School of Languages, Inc., Acton, Mass. for Army Cold Reg. Res. and Eng. Lab.
(AD-711904) Avail: NTIS CSCL 8/12

Any rational system for constructing building foundations in regions where permafrost and deep seasonal freezing are prevalent is impossible without due regard for the heaving forces which are built up during freezing of the ground. However, the data on the actual magnitude of these forces are incomplete. One factor which hinders experiments for determining heaving forces under field conditions appears to be undeveloped methods and the lack of enough simple procedural methods for such determinations. The purpose of the work was to test a new system for determining heaving forces under field conditions and development of some recommendations for using such a system. Author (TAB)

N71-12060*# Long Island Univ., Greenvale, N.Y. Science Engineering Research Group.
NASA APOLLO 9 So65 EXPERIMENT: MULTISPECTRAL TERRAIN PHOTOGRAPHY
Edward Yost, Robert Anderson, and Sondra Wenderoth 15 Jan. 1970 253 p refs
(Contract NAS9-9341)
(NASA-CR-108562; SERG-TR-13) Avail: NTIS CSCL 08F

A quantitative study of multispectral photography of the earth obtained from the SO65 experiment carried aboard Apollo 9 is reported. Analysis of the multispectral camera array showed sufficient spectral separation of each band, balance of photographic exposure, and relative spatial accuracy to allow additive color analysis of the imagery to be performed. Subsequently, a photographic reprocessing technique was developed for use in conjunction with additive color viewing. Colorimetric study of these additive color renditions indicated they were significantly superior to color infrared films in identifying water, vegetation, soil, and crops. By comparison they had 10 times greater capability in discriminating subtle water detail. Spectroradiometric measurements of incident solar radiation and radiation reflected by the Willcox Playa were made and related to the SO65 multispectral photography taken at the same time. Computer analysis of the spectral data indicated that is it feasible to obtain quantitative relationships between the percent of directional reflectance of terrestial objects in order to predict filter characteristics for optimum image formation from space sensors. E.M.C.

N71-12064# Norwegian Defence Research Establishment, Kjeller.
NORSAR (NORWEGIAN SEISMIC ARRAY). PHASE 2: THE 1968 INSTALLATION PROGRAM Technical Report, 1 Jan.–31 Dec. 1968
26 Nov. 1969 106 p refs Sponsored in part by OAR
(Contract F61052-68-C-0060; ARPA Order 800)
(AD-711069; NDRE-S-45; ESDR-TR-70-300) Avail: NTIS CSCL 8/11

Project NORSAR concerns installation and operation of a large seismic array in S-E Norway. This report covers that part of the NORSAR Phase 2 installation which has customary been entitled the 1968 Installation Program. It covers the field installations of the so-called A and B-ring subarrays, i e the innermost 8 subarrays of the array, and to some extent also the establishing of the Data Processing Center at Kjeller and the telecommunication channels linking the latter to the individual subarrays. Various circumstances made it necessary that the 1968 Installation Program was extended in time well beyond the calendar year 1968. The period covered by this contract expires late spring 1969. Author (TAB)

N71-12071# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
INVESTIGATION OF SNOW THAWING USING RADIOACTIVE ISOTOPES
Yu. N. Ageskie [1970] 9 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Geofiz (Moscow), no. 4, 1960 p 117–121
(AD-711907) Avail: NTIS CSCL 8/12

Study of the influence of agrotechnical measures on runoff is one of the themes on which experimental work is being done for study of slope runoff in special runoff areas and drainage gullies. In the investigations of the course of springtime snow thawing, as one of the factors involved in runoff, a method was used which made it possible to study this process without disrupting its natural course, which is inevitable when using an instrument based on the snow-weighing principle. This requirement now is satisfied best by use of the radioactive isotopes method. Using this method it is possible with sufficient accuracy to study the change of the water reserves in the snow at the time of thawing, tracing its diurnal variation on different underlying surfaces and under different conditions (forest, glade, open plowed land). Author (TAB)

N71-12072# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
THE INFLUENCE OF THE SOIL-FORMATION PROCESS ON THE COMPOSITION AND PROPERTIES OF THE DEPOSITS OF THE SEASONALLY FREEZING AND SEASONALLY THAWING LAYERS
L. N. Maksimova 1970 14 p refs Transl. into ENGLISH from Merzlotnye Issled. Sb. Statei (USSR), no 7, 1967 p 87–97
(AD-711888) Avail: NTIS CSCL 8/13

Data are cited which indicate the complex and multiform influence of the soil-forming process on the composition, properties and structure of the seasonally freezing and seasonally thawing layers. Author (TAB)

N71-12073# Army Coastal Engineering Research Center, Washington, D.C.
CERC BULLETIN AND SUMMARY OF RESEARCH PROGRESS FISCAL YEARS 1967–1969, VOLUME 3
Jul. 1970 81 p refs
(AD-711940) Avail: NTIS CSCL 8/3

Contents: Long-period waves and surges; Shore protection in bays, lakes and reservoirs; Biological-ecological studies; and Environmental data collection. TAB

N71-12074# California Univ., Berkeley. Hydraulic Engineering Lab.
EMPIRICAL PROBABILITY DISTRIBUTIONS FOR ASTRONOMICAL WATER HEIGHT
R. D. Borchardt and L. E. Borgman Jul. 1970 37 p refs
(Contract DACW71-68-C-0002)
(AD-711966; HEL-16-6) Avail: NTIS CSCL 8/3

The hourly astronomical water height was calculated for Crescent City, California and San Francisco, California. Empirical probability distributions calculated from 369 day intervals of these data show characteristics similar to those of a beta distribution. The empirical probability distribution derived for the tsunami of May 22, 1960 as recorded at Crescent City, California is sharply peaked and symmetric with respect to the mean. The computer programs for the calculations are described. Author (TAB)

N71-12082# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
HORIZONTAL TRANSPORT OF SNOW IN ANTARCTICA
N. P. Rusin [1970] 13 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 96, 1959 p 31–37
(AD-711914) Avail: NTIS

The article describes the quantitative and qualitative characteristics of the horizontal transport of snow on the coast of Antarctica. Author (TAB)

N71-12083# Oregon State Univ., Corvallis. Dept. of Oceanography.
[DEPARTMENT OF OCEANOGRAPHY]RESEARCH ACTIVITIES Progress Report, 1 Oct. 1969–31 Mar. 1970
Beverly Knapp, ed. Jul. 1970 91 p refs Sponsored in part by Dept. of Interior, Geol. Survey, ESSA, and NSF *Its* Ref. No 70
(Contracts N00014-67-A-0369-0007; N00014-67-A-0369-0001; N00014-68-A-0148; AT(45-1)-1750; Grant PHS-G-ES-00026-08 et al)
(AD-710765; PR-25) Avail: NTIS CSCL 8/3

Contents: Multidisciplinary oceanography; Physical oceanography; Geological oceanography; Geophysical oceanography; Chemical oceanography; Radioecological oceanography; and Biological oceanography. TAB

N71-12087# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
ICINGS IN THE USSR AND THEIR CONTROL
A. M. Chekotillo et al 1970 261 p refs Transl. into ENGLISH of the Book 'Naledi na Territorii SSSR i Borba s Nimi' Blagoshchensk, Amur Publishing House, 1960 p 1–207
(AD-711933) Avail: NTIS CSCL 8/12

Contents: Icing and its types; First information on icing; Basic factors in icing formation; The geological and hydrological structure of an area; The theory of icing formation; Water pressure in icings; The influence of icings on structures; Methods of combatting icing; and Icing and anti-icing structures on the Urgal–Izvestkovaya railway line. Author

N71-12088# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
MEASUREMENT OF STRESS WAVES IN SOFT SOIL
V. D. Alekseyenko et al 1970 16 p refs Transl. into ENGLISH from Prikl. Mat. i Tekhn. Fiz. (USSR), no. 2, 1963 p 135–141

(AD-711864) Avail: NTIS CSCL 19/4

The problems associated with the propagation of explosive waves in soil are of known urgency. It is interesting to calculate the wave pattern developing in soil close to the focus of the explosion (underground or above ground) or during the passage of the shock wave from the air or water into the soil. At considerable distances from the focus, this pattern can be described by the equations taken from the theory of elasticity; however, at closer distances, these equations are unsuitable and must be replaced by another system of formulas, taking into account the complex nature of the deformation and flow of the medium at high stresses, and only at the boundary in case of reduction of stresses do we transfer to the equations taken from the linear theory of elasticity. Such a type of mathematical model of the medium has been suggested for describing the movements of soft soil (sand, clay, etc.). Author

N71-12090# Natural Environment Research Council, London (England).

REPORT OF THE [NATURAL ENVIRONMENT RESEARCH] COUNCIL FOR THE PERIOD 1 APRIL 1969–31 MARCH 1970

23 Jul. 1970 113 p refs
Avail: HMSO 13s; BIS $2.80

The activities of the Natural Environment Research Council of Great Britain, which was established to plan and execute research in the physical, geological, and biological sciences that relate to man's natural environment and its resources, are reported for the period April 1969 to March 1970. Reports of the individual research establishments are given. R.B.

N71-12092# Lockheed Missiles and Space Co., Sunnyvale, Calif. Ocean Lab.

A COMPARISON OF IN-SITU AND LABORATORY VANE SHEAR MEASUREMENTS

A. L. Inderbitzen, F. Simpson, and G. Goss Nov. 1970 35 p refs
(LMSC-681703) Avail: NTIS

In-situ (in place) vane shear measurements and penetration tests were made to depths of 133 cm into the sea floor sediment. These tests were made in the San Diego Trough off San Diego, California, at a water depth of 1,240 meters. The bottom consisted of silty clay material which was uniform throughout the test area. Sediment cores were obtained 60 to 90 cm from five of the six in-situ test sites. Vane shear measurements were made in the laboratory on the core samples at the same depths as the in-situ tests and results compared. Results of the study indicate that the vane shear strengths determined by in-situ tests are consistently higher than the laboratory test values. The laboratory determined vane shear strength values were 2 to 36 percent lower than the respective in-situ value for that depth and site. The closest agreement between in-situ and laboratory vane shear strength values occurred in the middle section of the cores. All the in-situ test profiles exhibited an increase in shear strength with depth, but the profiles based upon laboratory vane shear strength measurements were erratic. Greatest vertical variation in shear strength values occurred in the top 30 cm of sediment depth. Author

N71-12093# Air Force Cambridge Research Labs., Bedford, Mass. Ionospheric Physics Lab.

PULSE SOUNDING WITH CLOSELY SPACED RECEIVERS AS A TOOL FOR MEASURING ATMOSPHERIC MOTIONS AND FINE STRUCTURE IN THE IONOSPHERE. 4: WAVE-LIKE STRUCTURE IN THE E-REGION DERIVED FROM DRIFT EXPERIMENTS

W. Pfister 11 Aug. 1970 35 p refs *Its* Environ. Res. Papers No. 329
(AD-712346; AFCRL-70-0461) Avail: NTIS CSCL 4/1

A modification of the familiar fading experiment with three or more receivers measures phase fluctuations in addition to the amplitude fluctuations. This information can be used in a generalized correlation and spectral analysis which describes the statistical behavior of the radio wave packet returned from the reflection level. The experimental results can be interpreted as a super-position of a finite number of wave packets, each representing reflection from a rough surface. The different reflection surfaces are located in somewhat different directions and show different doppler shifts. All samples analyzed so far show a remarkable linear behavior in the phase of the cross-spectrum which can only be interpreted as a consequence of the wave-like structure of the reflecting regions. Velocity and direction of propagation can be measured; however, the structure is not well-enough behaved for easy measurement of wavelength and frequency. A comparison between this generalized analysis and the customary full correlation analysis of amplitude data reveals agreement in direction but with higher velocities by a factor of about two. Author (TAB)

N71-12095# New Hampshire Univ., Durham. Dept. of Physics.

THE PHYSICAL STRUCTURE OF HYDROMAGNETIC DISTURBANCES IN THE INNER MAGNETOSHEATH

Richard L. Kaufmann and Jiann-Tsorng Horng Oct. 1970 20 p refs
(Grant NSF GA-14954)
(UNH-70-19) Avail: Issuing Activity

A physical model is described of the field structure that exists in the inner magnetosheath during highly disturbed periods. Low-field regions are believed to be associated with plasma condensations or clouds. The magnetic field direction fluctuates by as much as 45 deg in these low-field regions. Elsewhere, the field is relatively steady, and nearly tangent to the magnetopause. One characteristic dimension of a typical low-field region is about 1000 km. Most such regions are more extended than this along the average field direction, so that they appear either as tube-like or as sheet-like structures that are aligned approximately tangent to the magnetopause. Author

N71-12121# Joint Publications Research Service, Washington, D.C.

EXPERIMENTAL INVESTIGATIONS OF TOTAL WATER VAPOR CONTENT OVER THE OCEAN DURING RADIOMETRIC MEASUREMENTS OF ATMOSPHERIC THERMAL RADIATION FROM A SHIP

V. M. Plechkov et al 4 Nov. 1970 5 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (USSR), v. 193, no. 5, 1970 p 1041–1043
(JPRS-51715) Avail: NTIS

Radiometric observations for determining atmospheric moisture content over the ocean surface are discussed. The measurements involved observations of atmospheric thermal radio emission near the water vapor absorption line at different zenith angles and corresponding emission of the ocean surface. The amount by which the vertical absorption of radio waves occurred provided a measure of the total water vapor mass in a vertical column of the atmosphere. Information on instrumentation and computation formulas is presented. Author

N71-12141# Naval Weapons Lab., Dahlgren, Va. Warfare Analysis Dept.

POLAR MOTION DETERMINATIONS BY US NAVY DOPPLER SATELLITE OBSERVATIONS

R. J. Anderle Jul. 1970 83 p refs
(AD-712058; NWL-TR-2432) Avail: NTIS CSCL 8/5

The irregular motion of the earths axis of rotation, know as Chandler Wobble, was determined on the basis of Doppler observations of Navy Navigation Satellites. Measurement precisions of about 0.5 meters have been obtained for averaging times of six days. Agreement with astronomical determinations is better than one meter over the last two years. The discrepancies are no longer than differences between results for different groups of observatories as reported by the Bureau International de L'Heure and the International Polar Motion Service. Author (TAB)

N71-12142# Environmental Research Corp., Alexandria, Va.

EFFECTS OF LOCAL GEOLOGY ON THE AMPLITUDES OF SEISMIC WAVES, VOLUME 3

J. R. Murphy, N. L. Weaver, and G. B. Lamers Jun. 1970 142 p refs

(NVO-1163-205-Vol-3) Avail: NTIS

The analyses presented provide additional physical insight into the effects of local geology on the amplitude of seismic motion. The mathematical models available to describe amplification are presented and their limitations indicated. The geology of a number of Nevada Test Site seismic recording stations are described in detail and the quality of the available physical property data assessed. A useable experimental amplification factor is defined in such a way that it is meaningful in terms of the available mathematical models. Experimental amplification factors were obtained for a wide variety of station geologies, ground motion intensities and epicentral distances. The observations are compared with the output of the various analytical models and the validated models subjected to a thorough parameter study. Author (NSA)

N71-12143# Environmental Research Corp., Alexandria, Va.

ANALYSIS OF SELECTED EFFECTS ON PEAK GROUND MOTIONS GENERATED BY UNDERGROUND NUCLEAR DETONATIONS

A. P. Whipple and L. J. O'Brien Jun. 1970 83 p refs

(Contract AT(29-2)-1163)

(NVO-1163-TM-20) Avail: NTIS

Ground motion peak amplitude data recorded from 109 underground nuclear events varying in yield from about 1 kt to over one megaton are analyzed. The total ground motion measurements, recorded at approximately 600 different recording sites, include 1,344 acceleration, 910 velocity, and 1,342 displacement values of the peak resultant vector. The study of this large, diversified data sample resulted in a set of peak ground motion prediction equations for hard rock and alluvium recording site media. Recording site medium and the detonation site medium significantly affect the ground motions recorded at a particular site. Regression equations expressing peak vector amplitude as a power law function of yield and range were derived. Regression equations were also derived to establish relationships among some of the most common source media. Other regression equations were also derived for the prediction of ground motions corresponding to each of the three mutually orthogonal instrument orientations, subdivided according to hard rock and alluvium recording sites. Author

N71-12147# Academy of Sciences (USSR), Moscow.

METHODS OF DATA REDUNDANCY REDUCTION BY MEANS OF SYSTEMATIZATION AND ANALYSIS OF DATA SOURCES

V. I. Berezin, V. I. Cluev, and V. A. Sviridenko 1970 19 p refs

Presented at the 21st Intern. Astronaut. Congr., Constance, West Ger., 4-10 Oct. 1970

Avail: NTIS

The possibility of developing a telemetry system intended for scientific information processing where the redundancy of transmitted data is reduced to minimum value by means of systematization and analysis of sensor outputs is discussed. A set of sensors, the indications of which represent different physical processes, is divided into subsets i.e. groups of sensors which are similar in nature and character of time variation of the measured physical values. In each group a priority sensor is singled out, the indications of which determine the importance of information for all sensors of the group. An analysis of indications of priority sensors is performed and those are excluded from the information flow where a significant change in indications has not taken place in different intervals of reading flow. The entire redundancy reduction procedure consists of several other stages which are described. Author

N71-12155# Joint Publications Research Service, Washington, D.C.

OCEANOGRAPHY

In its Soviet-Bloc Res. in Geophys., Astronony, and Space, No. 238 13 Oct. 1970 p 10–21 refs (See N71-12152 02-34)

Avail: NTIS

Oceanographic news is reported on study of mineral resources of the sea floor, experiments of Soviet underwater laboratories, exploitation of resources on the continental shelf, and Soviet-Bulgarian cooperation in Black Sea research. Selected abstracts of scientific articles are included on primary production in the central Pacific Ocean, prediction of long-term water temperature variations, calculation of sound velocity distribution in the Caspian Sea, river runoff of microelements from USSR land mass, the temperature regime and turbulent heat exchange in the surface layer of the sea, carbohydrates in bottom sediments in the central Pacific Ocean, and seasonal changes of water masses off California. R.B.

N71-12156# Joint Publications Research Service, Washington, D.C.

TERRESTRIAL GEOPHYSICS

In its Soviet-Bloc Res. in Geophys., Astronomy and Space, No. 238 13 Oct. 1970 p 22 refs (See N71-12152 02-34)

Avail: NTIS

A method is described for calibrating shipborne nonastaticized gravimeters. The method is based on tilt in the pendulum oscillation plane and is shown to be superior to methods which employ tilt along the direction of the suspension filaments. R.B.

N71-12164# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.

IMPACT OF DOUGLAS-FIR TUSSOCK MOTH, COLOR AERIAL PHOTOGRAPHY EVALUATES MORTALITY Final Report

Steven L. Wert and Boyd E. Wickman 1970 10 p refs *Its* Forest Serv. Res. Paper PSW No. 60

(PB-193698) Avail: Issuing Activity CSCL 20F

Thorough evaluation of insect impact on stands is difficult and expensive on the ground. In a study of tree damage following Douglas-fir tussock moth defoliation in Modoc County, California, large-scale (1:1,584) 70-mm. color aerial photography was an effective sampling tool and took less time and expense than ground methods. Comparison of the photo interpretations with a sample ground cruise gave high correlations (0.78 to 0.095) for tree mortality and top kill, and an estimate of mortality made from photos was within 5 percent of the ground cruise estimate. Author (USGRDR)

N71-12165# Navy Underwater Sound Lab., New London, Conn. Ocean Sciences Div.

REAL-TIME PROCESSING OF ACOUSTIC AND OCEANOGRAPHIC DATA AT SEA

Raymond W. Hasse and Robert L. Martin 16 Jun. 1970 29 p refs

(AD-711598; USL-1039) Avail: NTIS CSCL 8/10

A data acquisition and analysis system was developed and installed aboard the oceanographic research vessel USNS SANDS 9AGOR-6) to provide a capability for comprehensive data analysis at sea, including the ability to perform data processing in real time. The system is built around the UNIVAC 1230 computer. Peripheral equipment permits up to 64 channels of data to be fed to the computer through a 50-kHz A/D multiverter. The processed output is displayed on a high-speed on-line printer-plotter. Four tape decks for data storage and read-out permit continuous operation with no off-line time required for changing tape or data read-out. The system was used extensively during a 3-1/2 month cruise devoted to oceanographic and acoustic studies on a track from New London, Connecticut, to Hawaii and return. The processing system was also required to be on line continuously for a three-week period for acoustic propagation studies conducted in the North Pacific. These tests proved highly successful and demonstrated the desirability of at-sea data processing by permitting scientists aboard ship the opportunity to collect, process, and evaluate results during the course of the experimental exercise. Author (TAB)

N71-12167# Environmental Research Corp., Alexandria, Va.
OBSERVED SEISMIC DATA, PIPKIN EVENT
May 1970 70 p refs
(Contract AT(29-2)-1163)
(NVO-1163-210) Avail: NTIS

The results of the processing of the observed ground motions for the Pipkin event, an underground nuclear detonation on Pahute Mesa at the Nevada test site are presented. Ground motion data recorded at 36 instrument stations deployed by the United States Coast & Geodetic Survey were processed by Environmental Research Corporation Data Processing Laboratory. The peak resultant vector amplitudes were calculated and plotted as a function of distance and regression equations were derived. Pseudo-relative velocity spectra at 5% damping were derived from the velocity seismograms. Author (NSA)

N71-12168# Ohio State Univ., Columbus. Dept. of Geodetic Science.
THE COVARIANCE MATRIX FOR DEFLECTIONS OF THE VERTICAL AND UNDULATIONS BASED ON ACTUAL GRAVITY DATA
Gabriel F. T. Obenson Jun. 1970 26 p refs
(Contract F19628-69-C-0127)
(AD-712351; AFCRL-70-0408; DGS-136; SR-9) Avail: NTIS CSCL 8/5

In computing the undulation of the geoid and deflections of the vertical at any point, the computations are generally divided into those for an inner zone and those for an outer zone. In this paper, the inner zone is made up of four rectangular belts. Equations for computing the coefficients of the gravity anomalies of each rectangle are derived. Assuming that standard errors of all anomalies are known, the coefficients obtained above can also be used to estimate the accuracies of the undulations and deflections. In a sample computation done, it was found that while there is practically no correlation between the three quantities at one point, there is varying correlation with those at other points. The correlation between all the parameters is minimum for two points only if they are separated by a spherical distance of approximately 100 degrees. Author (TAB)

N71-12169# Akademiya Nauk URSR, Kiev.
SPECTROPHOTOMETRY OF THE EARTH FROM MANNED SPACECRAFTS (FROM THE DATA OF "SOYUZ 7" AND "SOYUZ 9")
K. Ya. Kondratyev, A. A. Buznikov, L. I. Chapursky, V. V. Gorbatko, A. A. Grigoryev et al [1970] 15 p refs Presented at the 21st Intern. Astronaut. Congr., Constance, West Ger., 4-10 Oct. 1970
Avail: NTIS

The results are presented of a program aimed at establishing accurate information about the earth's surface by correlating photography and spectrophotometry data obtained by manned spacecraft with similar data from aircraft instrumentation. The sectrography of the earth's surface from the Soyuz-7 and Soyuz-9 manned spacecraft was conducted in the nadir through an illuminator by means of a manual spectrograph. Aerial photography of the same region was made by LI-2 and IL-18 aircraft with instrumentation similar to that used on the Soyuz spacecraft. The data obtained are described and their significance is discussed. D.L.G.

N71-12192# Ohio State Univ. Research Foundation, Columbus. Dept. of Geodetic Science.
A GENERAL COMBINATION OF SATELLITE AND GRAVITY DATA FOR POSITION AND GRAVITY FIELD DETERMINATIONS
Richard H. Rapp Jun. 1970 34 p refs
(Contract F19628-69-C-0127)
(AD-712348; AFCRL-70-0343; Rept-133; SR-6) Avail: NTIS CSCL 8/5

The report is concerned with the combination of terrestrial information and satellite information for the determination of geocentric station positions alone, or geocentric station positions and gravitational potential coefficients. The method uses terrestrial information such as astronomic latitude and longitude, gravimetrically derived deflections of the vertical and height anomalies, with an adopted reference figure to define a geocentric position. The satellite data will include geocentric station positions and potential coefficients. The two models formed in this paper use a datum shift vector as the intermediate quantity. All equations for the necessary computations are made with no numerical results being obtained at this time. Author (TAB)

N71-12193# Ohio State Univ. Research Foundation, Columbus. Dept. of Geodetic Science.
THE ROLE OF GRAVITY DATA IN THE DETERMINATION OF THE GRAVITATIONAL POTENTIAL OF THE EARTH
Richard H. Rapp May 1970 24 p refs
(Contract F19628-69-C-0127)
(AD-712349; AFCRL-70-0375; Rept-134; SR-7) Avail: NTIS CSCL 8/5

The determination of the exterior potential field of the earth may be carried out using satellite observations, gravity observations, or a combination of both. This paper is concerned with how accurately we can describe the gravitational potential coefficients of the earth based on gravity data alone. This problem is considered from the viewpoint of existing and potential gravity material. Comparisons are made with accuracies being obtained from current satellite determinations of potential coefficients. The limitations and the advantages of using gravity data are discussed. Author (TAB)

N71-12197# American Meteorological Society, Boston, Mass.
BIBLIOGRAPHY ON METEOROLOGY, CLIMATOLOGY, AND PHYSICAL/CHEMICAL OCEANOGRAPHY, VOLUME 1 Cooperative Investigation of the Caribbean and Adjacent Regions
Washington Natl. Oceanog. Data Center 1970 390 p refs
Sponsored by Natl. Oceanog. Data Center and The Gulf Univ. Res. Corp.
Avail: Issuing Activity

An abstracted bibliography, compiled from the files of the Meteorological and Geoastrophysical Abstracts Office of the American Meteorological Society and from files of the Government Libraries in the Washington, D.C. area, is presented. It provides the participants of the Cooperative Investigation of the Caribbean and adjacent Regions with a comprehensive and timely review of the published literature in physical/chemical oceanography and in meteorology/climatology concerned with the Caribbean Sea, Gulf of Mexico, Greater and Lesser Antilles Regions, and the adjacent areas of North, Central, and South America. Articles dealing with weather phenomena outside of this geographical region, but influencing the atmosphere within the area, were included. Author

N71-12198# American Meteorological Society, Boston, Mass.
BIBLIOGRAPHY ON METEOROLOGY, CLIMATOLOGY, AND PHYSICAL/CHEMICAL OCEANOGRAPHY, VOLUME 1 INDEXES Cooperative Investigation of the Caribbean and Adjacent Regions
Washington Natl. Oceanog. Data Center 1970 243 p refs
Sponsored by Natl. Oceanog. Data Center and The Gulf Univ. Res. Corp.
Avail: Issuing Activity

For abstract see N71-12197.

N71-12199*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
EARTH RESOURCES RESEARCH DATA FACILITY INDEX
Jul. 1970 419 p refs Revised
(NASA-TM-X-66487; MSC-02576-Rev) Avail: NTIS CSCL 08E

The cumulative issue of the Earth Resources Research Data Facility (ERRDF) Index is presented. All Earth Resources Program information and related data that is available at the National Aeronautics and Space Administration's Manned Spacecraft Center are listed. Included in the Index are data collected during flights over test sites and from studies made by investigators supporting the Earth Resources Survey Program. The information is cataloged into four major categories as follows: (1) technical documents and maps, (2) functional and check out data, (3) imagery data, and (4) electronic data. Author

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N71-11383# Texas Instruments, Inc., Dallas. Services Group.
UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME 1: STATE-OF-THE-ART OF OCEANOGRAPHIC AND METEOROLOGICAL SENSORS, TUTORIAL DISCUSSION
Robert J. Gaillard, Kenneth I. Heldelbrandt, Robert M. Crosby, and Thomas Cass 21 May 1970 212 p refs
(Contract DOT-CG-90505-A)
(AD-711322; TI-59009-LA-Vol-1) Avail: NTIS CSCL 14/2

Task 1, in two volumes, evaluates the state-of-the-art of oceanographic and meteorological sensors. Instruments for the measurement of a number of oceanographic parameters from different platforms are evaluated with respect to the operational requirements laid down by the United States Coast Guard. Conclusions are drawn relevent to these requirements -- i.e., what measurements with specified accuracies can be accomplished from specific platforms, what may be accomplished during the next 5 years, and what is beyond the 5-year state-of-the-art. Author (TAB)

N71-11384# Texas Instruments, Inc., Dallas. Services Group.
UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME 2: STATE-OF-THE-ART OF OCEANOGRAPHIC AND METEOROLOGICAL SENSORS, CATALOG
Robert J. Gaillard, Kenneth I. Helderbrandt, Robert M. Crosby, and Thomas Cass 21 May 1970 345 p
(Contract DTO-CG-95050-A)
(AD-711323; TI-59009-LB-Vol-2) Avail: NTIS CSCL 14/2

Task 1, in two volumes, evaluates the state-of-art of oceanographic and meteorological sensors. Instruments for the measurement of a number of oceanographic parameters from different platforms are evaluated with respect to the operational requirements laid down by the United States Coast Guard. Conclusions are drawn relevent to these requirements -- i.e., what measurements with specified accuracies can be accomplished from specific platforms, what may be accomplished during the next 5 years, and what is beyond the 5-year state-of-the-art. Author (TAB)

N71-11385# Texas Instruments, Inc., Dallas. Services Group.
UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME 3: THE SURVIVAL ENVIRONMENT FOR OCEANOGRAPHIC AND METEOROLOGICAL SENSORS
Robert M. Crosby, Frank H. MacDonald, Thomas R. Livermore, and William Gumma 21 May 1970 126 p refs
(Contract DOT-CG-90505-A)
(AD-711305; TI-59009-2-Vo;-3) Avail: NTIS CSCL 14/2

Task 2 describes the operational, transport, and storage environments for oceanographic and meteorological field instruments. The study resulted in recommendations for environmental protection and called attention to areas needing further work in order to accomplish adequate sensor protection at sea. Author (TAB)

N71-11386# Texas Instruments, Inc., Dallas. Services Group.
UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME 4: THE FORMATTING AND TRANSMISSION OF DATA FROM OCEANOGRAPHIC SENSOR, TASK 3
Wilton J. Daniel, Jr. and Jerry R. Yeargan 21 May 1970 170 p refs
(Contract DOT-CG-90505-A)
(AD-711326; TI-59009-3-Vol-4) Avail: NTIS CSCL 14/2

The report examines the problem of transmitting oceanographic data from underwater sensors to a variety of surface platforms as constrained by operational requirements set forth by the United States Coast Guard. Recommendations concerning a system to meet these requirements are made. The report also examines the formats necessary to convey the information collected from the platforms to users of both perishable and archived data. Author (TAB)

N71-11387# Texas Instruments, Inc., Dallas. Services Group.
UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME 5: ANALYSIS OF APPLYING STANDARDIZATION TECHNIQUES TO OCEANOGRAPHIC SENSORS
P. David Call and Wilton J. Daniel, Jr. 3 Jun. 1970 63 p refs
(Contract DOT-CG-90505-A)
(AD-711327; TI-59009-4-Vol-5) Avail: NTIS CSCL 14/2

The report examines the areas in which oceanographic ensors can be standardized to meet the operational requirements et forth by the United States Coast Guard. Recommendations are nade for areas in which cost reductions can be realized through he use of standards. Author (TAB)

N71-11388# Texas Instruments, Inc., Dallas. Services Group.
UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME 6: TEST REQUIREMENTS FOR OCEANOGRAPHIC AND METEOROLOGICAL SENSORS
Frank H. MacDonald, Lawrence B. Sullican, and Thomas R. Livermore 31 May 1970 199 p refs
(Contract DOT-CG-90505-A)
(AD-711328; TI-59009-5-Vol-6) Avail: NTIS CSCL 14/2

Task 5 was concerned with the development of test and calibration techniques required to measure the sensor compliance with the performance, mechanical, and electrical specifications. A test program was written that provides for a rigorous examination of each basic sensor design as it applies to performance in the operational environment and its ability to survive the environment imposed by storage, transportation, predeployment, and deployment handling. Author (TAB)

N71-11421*# Toronto Univ. (Ontario). Inst. of Aerospace Studies.
STUDY OF THE BARRINGER REFRACTOR PLATE CORRELATION SPECTROMETER AS A REMOTE SENSING INSTRUMENT
Millan M. Millan, Stanley J. Townsend, and John Davies (Barringer Research Ltd.) Aug. 1970 100 p refs Supported in part by Natl. Res. Council Revised

(Contracts NAS8-9492; PH-22-68-44; Proj. Optics 912)
(NASA-CR-111373; UTIAS-146-Rev) Avail: NTIS CSCL 20F

A theoretical study of the Barringer refractor plate correlation spectrometer is made, and several applications of the sensor are considered for the remote sensing of pollutant gases in the atmosphere. The instrument is intended to detect and measure the amount of a specified gas present between a suitable light source and the sensor. The technique used is that of correlation spectroscopy which is based upon the measurement of the degree of similarity between the molecular absorption spectrum of a chosen gas and the actual total absorption spectra of all the gases seen by the instrument. The mechanical and electrical characteristics of the instrument are described, and an analysis is performed of the optical characteristics of the instrument. The interactions between the characteristics of the light source irradiating the gas, the transmission spectrum of the instrument, the transmission spectrum of the correlation mask and the electronic circuitry are discussed. The application of the instrument to the remote sensing of pollutants in smokestack plumes and to the remote sensing of ground-covering atmospheric pollutants from a balloon-supported platform is discussed. Author

N71-11506*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

AN OPTICAL IMAGE COMPARATOR FOR EXAMINATION OF FIELD ION MICROGRAPHS

J. C. Gregory and I. Dalins 8 Apr. 1970 13 p refs
(NASA-TM-X-64514) Avail: NTIS CSCL 20F

A description is given of a device which permits direct comparison of two complex recorded images or patterns. Any small differences between the two images, normally difficult to detect by visual inspection, are distinctly illuminated and readily noticed by the observer despite the mass of complex detail common to both images. The instrument was designed as an aid to single atom studies in the field ion microscope but may also be of application in astronomy. Author

N71-11507*# Tennessee Technological Univ., Cookeville. Dept. of Engineering Science.

A DYNAMIC POLARISCOPE FOR STRESS WAVE ANALYSIS

Ray Kinslow Jul. 1970 21 p refs
(Grant NGR-43-003-007)
(NASA-CR-108690; TTU-ES-70-2) Avail: NTIS CSCL 20F

A polariscope for the study of the propagation of stress waves in birefringent sheets is described. Very sensitive, fast-responding photomultiplier tubes, a laser light source, and a multiple channel oscilloscope were used for the simultaneous recording of the stress-optic data at several points of the target following impact. A method of separation of stresses and the computation of displacement, strain, and stress is given. Author

N71-11508# Stanford Univ., Calif. Microwave Lab.

LOW TEMPERATURE SILICON THERMOMETER AND BOLOMETER Final Report

R. Bachmann, H. C. Kirsch, and T. H. Geballe Aug. 1970 18 p refs
(Contract N00014-67-A-0112-0037)
(AD-711960; ML-1886) Avail: NTIS CSCL 14/2

By simple diffusion and etching procedures low temperature sensitive surface layers can be prepared on otherwise insulating silicon substrates. Temperature coefficients of the resistance of these layers of the order of unity can be obtained at any temperatures below 20K. The usefulness of the silicon device as a low temperature thermometer and bolometer is demonstrated. Author (TAB)

N71-11522# European Space Research Inst., Frascati (Italy).

MINIMUM IMAGE SIZE IN AN ELECTROSTATIC SPECTROGRAPH

G. A. Proca and T. S. Green Jun. 1970 25 p refs Submitted for publication
(ESRIN-IN-93) Avail: NTIS

Previous analysis of the focusing properties of an electrostatic spectrograph has shown that second order focusing can be achieved. It is demonstrated that as a corollary, there exists an optimum focal line in which the angular aberrations are reduced to one quarter of their values on the normal focal line, as is the case in optical systems. Results of computations of the line shapes are also presented. Author (ESRO)

N71-11523# United Kingdom Atomic Energy Authority, Culham (England).

THE DESIGN OF A ROCKETBORNE CASSEGRAIN TELESCOPE

H. J. B. Paxton and R. F. Turner London Sci. Res. Council 1970 22 p Presented at the Brit. Interplanet. Soc. Symp. on Advanc. in Space Res. and Technol., London, Sep. 1970
(ARU-BIS-1) Avail: NTIS

A Cassegrain telescope system for the immediate needs of astrophysicists studying stellar spectra in the ultraviolet region of the electromagnetic spectrum between the wavelengths 900 and 3300 A is described. The equipment is designed to be flown on Skylark rockets with either Cuckoo or Goldfinch boosters, and specifically for the Starling star pointing system. Mechanical and thermal stress problems are discussed. Author (ESRO)

N71-11524# European Space Research Inst., Frascati (Italy).

A SPECTROGRAPH FOR THE SIMULTANEOUS MEASUREMENT OF VELOCITY SPECTRA AND CHARGE-TO-MASS RATIOS OF IONS

T. S. Green [1970] 18 p refs Submitted for publication
Avail: NTIS

The design of a new ion spectrograph is described. Using magnetic deflection, analysis can be made of the velocity spectrum of the ions. For a given entrance angle to the magnetic field the foci lie on a straight line and second order focusing can be obtained. Application of an electric field parallel to the magnetic field causes displacement of the focal line to an extent determined by the charge-to-mass ratio of the ion. The image on the focal plane is thus a set of lines, one for each ion species, the velocity distribution being displayed along each line. Author (ESRO)

N71-11526*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

SPECTRAL IRRADIANCE MEASUREMENTS OF LARGE SOLAR SIMULATORS

Reagan S. Redman Washington Nov. 1970 10 p refs
(NASA-TN-D-6094; MSC-S-251) Avail: NTIS CSCL 14B

The statistical extrapolation of spectral irradiance data for a large solar simulator is discussed. This extrapolation is performed to allow prediction of the spectral irradiance of some point in the solar beam that has not been measured directly. Author

N71-11527# British Steel Corp., London (England). Intergroup Labs.

THE METALLURGICAL APPLICATIONS OF THE SCANNING ELECTRON MICROSCOPE

D. Dulieu [1969] 17 p refs
(M6/A/37/69) Avail: NTIS

The working principles of the scanning electron microscope are outlined. The use of the instrument for metallographic studies of both planar and roughened surfaces is discussed and examples of microstructure and fracture features are given. Author

N71-11530# Royal Aircraft Establishment, Farnborough (England).

VISCOUS DAMPING AND HIGH OVERLOAD PROTECTION FOR LOW PRESSURE TRANSDUCERS

C. F. Lucas Feb. 1969 20 p refs
(RAE-TR-69032) Copyright. Avail: NTIS

The development of a viscous damping technique and an improved overload support for use with both differential and absolute pressure transducers are described. The damper effectively eliminates resonance of the diaphragm and the support enables the instrument to withstand an overload factor of at least fifty. Author

N71-11531# Royal Aircraft Establishment, Farnborough (England).

AN EXTERNALLY SYNCHRONIZED CLOCK FOR SATELLITE APPLICATIONS

P. H. Clarkson May 1969 20 p refs
(RAE-TR-69105) Copyright. Avail: NTIS

A system is presented for synchronizing the output waveform of a clock with a pulse whose frequency is lower than that of the clock. The system is described in general terms and details are given for an application in a satellite PCM data handling simulator. Suggested modifications for use in satellite applications are also given. Author

N71-11537*# Stanford Univ., Calif. School of Medicine.

AN IMPROVED CELL-VOLUME ANALYZER

J. T. Merrill, N. Veizades, H. R. Hulett, P. L. Wolf, and L. A. Herzenberg [1970] 37 p refs
(Grants NGR-05-020-004; NIH GM-17367; NIH CA-14681; NIH 5-TOI-GM-295-12)
(NASA-CR-111384) Avail: NTIS CSCL 14B

A cell-volume-sensing instrument has been built which employs the principle used in the Coulter counter in which a cell changes the impedance of a narrow orifice as it passes through the orifice. An improved transducer utilizes a coaxial flow of the cell suspension inside a sheath of cell-free solution through the orifice, thereby avoiding some drawbacks of earlier systems. The instrument is described, and the procedure necessary to achieve acceptable operation is discussed. The output for normal human red blood cells is nearly symmetrical with a narrow peak. Abnormal blood samples show various departures from symmetry and narrowness of peak. The output of this instrument is compared with that from a commercially available instrument, and these data show a more accurate representation of the actual distribution of blood volumes. The resolution of this instrument is such that it could be of significant value in a clinical laboratory. Author

N71-11544# National Physical Lab., Teddington (England). Aerodynamics Div.

CORRECTIONS FOR THE EFFECT OF AMBIENT TEMPERATURE DRIFT ON HOT-WIRE MEASUREMENTS IN INCOMPRESSIBLE FLOW

P. W. Bearman Oct. 1969 16 p refs
(NPL-AERO-1302) Copyright. Avail: NTIS

Simple methods for correcting hot-wire measurements in incompressible flow to allow for the effects of ambient temperature drift are presented. Correction formulae are derived for linearized and unlinearized constant-temperature hot-wire anemometers. The correction method for a linearized anemometer, which shows good agreement with experiment, is designed for use with the DISA type 55D10 linearizer. The correction formulae are based on the assumption that the properties of the fluid adjacent to the wire are related to the wire surface temperature. Author (ESRO)

N71-11545# Royal Aircraft Establishment, Farnborough (England).

A HIGH SPEED TELEVISION RECORDING SYSTEM WITH SLOW AND STOP MOTION REPLAY

A. Wilson Feb. 1970 28 p refs
(RAE-TR-70035) Copyright. Avail: NTIS

A television recording system is described which is designed to record rapid movements often occurring at unpredictable times. The picture signal is recorded on magnetic tape which enables instant replay of information at real time or slower rates to be achieved. The system provides 100 pictures per second which have 200 line resolution. The effective exposure time for each picture is 0.0001 second when electronic flash is used or 0.001 second when a rotating shutter is employed. Total recording time is 1 hour when one tape recorder is used. Author (ESRO)

N71-11546# Signals Research and Development Establishment, Christchurch (England).

SCANNING ELECTRON MICROSCOPY: A REVIEW OF THE FIRST TWO YEARS' WORK USING THE CAMBRIDGE STEREOSCAN MICROSCOPE

K. Head and Jean M. Plaw Mar. 1970 67 p refs
(SRDE-70023) Avail: NTIS

The work done using a scanning electron microscope covers in house applications, both within the parent group, and for other groups within the Establishment; work with contractors and research organizations on contract to the Ministry; and also work for outside industry on a cost shared basis. Some of the interesting items studied, which are reviewed in basically chronological order, are selected to illustrate the scope of the equipment, and show how a breakthrough in microscope technology has been achieved. Author (ESRO)

N71-11552# Royal Aircraft Establishment, Farnborough (England).

HIGH SPEED LENTICULAR SCREEN CAMERA WITH A MECHANICAL SHUTTER OF VERY SHORT SYNCHRONIZATION DELAY FOR SELF-ILLUMINATING EVENTS WHICH OCCUR AT AN UNDETERMINED TIME [LINSENRASTER-HOCHGESCHWINDIGKEITSKAMERA MIT EINEM MECHANISCHEN VERSCHLUSS KUERZESTER EIGENZEIT FUER SELBSTLEUCHTENDE, ZEITLICH UNBESTIMMTE EREIGNISSE]

Bernd Rudolf Koetzold Apr. 1970 12 p refs Transl. into ENGLISH from Proc. of the 8th Intern. Congr. on High Speed Phot. (Stockholm), 1968 p 172–175
(RAE-LIB-Trans-1444) Avail: NTIS

In order to investigate the behavior of an arc in a circuit-breaker during current zero, a simple mechanical multiple-lens camera was developed. The camera does not require synchronization of event and recording time. The mechanical shutter is of the closed-open-closed type and has infinite time-variation control. It can be triggered by the event to be recorded with a short synchronization delay. It can record 72 frames of 5 mm diameter at a rate of up to 300,000 frames per sec. The camera is applied to investigations in plasma research, particularly, to very luminous events which may occur at an undetermined time. Author

N71-11553# Royal Aircraft Establishment, Farnborough (England).

HIGH LIGHT INTENSITY IMAGE DISSECTION CAMERAS FOR SHORT DURATION RECORDINGS [LICHTSTARKE RASTERKAMERA FUER KURZAUFNAHMEN]

O. F. Grebennikov et al Apr. 1970 11 p refs Transl. into ENGLISH from Proc. of the 8th Intern. Congr. on High Speed Phot., (Stockholm), 1968 p 169–171
(RAE-Lib-Trans-1445) Avail: NTIS

An image dissection camera with equivalent relative aperture of 1:3 and frequency of up to 2 million frames per second was developed. The high light intensity was achieved by mounting a lenticular plate just in front of the photographic plate. This plate move with a velocity of 25 m/s during recording; this speed is made possible by a pneumatic drive. The camera has a synchronization system; the synchronizing signal can be given by the object to the camera or by the camera to the object. It is provided with a timer, an electromechanical shutter, and a series of lenses with different focal lengths. Photographic plates 130 × 180 mm are used, along with equipment supplied for printing the image on 16 mm film. Author

N71-11554# Royal Aircraft Establishment, Farnborough (England).

LIGHT INTENSITY OF ULTRARAPID IMAGE DISSECTION CAMERAS [LICHTSTARKE DER ULTRAPIDEN RASTERFILMKAMERAS]

O. F. Grebennikov Mar. 1970 18 p refs Transl. into ENGLISH from Proc. of the 8th Intern. Congr. on High Speed Phot. (Stockholm), 1968 p 165-168
(RAE-Lib-Trans-1443) Avail: NTIS

A method is proposed for the calculation of the effective illumination which takes into account diffraction and light scatter. The optical design of an ultrarapid image dissection camera is described. Author

N71-11561# Kernforschungszentrum, Karlsruhe (West Germany) Inst. fuer Angewandte Reaktorphysik.

THE DEVELOPMENT OF SEFOR ENERGY PROBES

H. Bumm, H. W. Glauner, E. Ruehl, W. Schikarski, and M. Tavosanis Dec. 1969 51 p refs In GERMAN
(KFK-1033; EUR-4307-C) Avail: AEC Depository Libraries

The development of the SEFOR energy probes for measurement of power transients is described. Energy probes use the direct temperature increase in fissionable material resulting from nuclear fission for the measurement of the power or the integral temperature change for measurement of the energy in a power excursion. A survey is given on the construction and material technological advancements in the development of the SEP. The determination of the dynamic properties by research in a cyclotron and a research reactor is reported. The SEP's studied have a response time constant which is below the required value of tau sub A = 1 msec and a heat conduction constant which is sufficiently large (about 350 msec) so that the measurement is not affected. An extensive discussion of the systematic errors, which can occur in the SEP stationary and dynamic operation is given. Author (NSA)

N71-11578# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

THERMAL MEASUREMENTS IN VOLCANIC GASES [MESURES THERMIQUES DANS LES GAZ VOLCANIQUES]

Jean Louis Boulay 1970 13 p refs In FRENCH Presented at the 4th Intern. Congr. on Heat Transfer, Versailles, France, 31 Aug.-4 Sep. 1970 Submitted for publication
(ONERA-TP-868) Avail: NTIS

For measuring temperatures and heat fluxes in gases emitted by active volcanoes several kinds of pickups were designed. These were successfully tested in September 1968 at Mount Etna, Sicily. The measurements obtained were the first of this kind. ESRO

N71-11595# Army Behavior and Systems Research Lab., Arlington, Va.

SEARCH EFFECTIVENESS WITH THE STARLIGHT SCOPE AND 7 BY 50 BINOCULARS

John P. Farrell, James H. Banks, and Jack J. Sternberg Jun. 1970 37 p refs
(AD-712318; BESRL-TR-1164) Avail: NTIS CSCL 17/8

The night operations program is concerned with problems in optimizing human performance in relation to night vision devices and related sensors. To further this research, experimentation has been directed toward enhancement of the performance of the combat soldier in night operations. The report describes an experimental evaluation or four passive night vision devices, and presents results of the assessment of operator performance with these devices in target detection and search tasks. Subjects were required to detect targets (soldiers or aggressor type silhouettes) presented in two modes. Responses were recorded electronically. Data obtained were analyzed to determine performance effectiveness with the two subject devices and the effects were studied of illumination (starlight, half moon, full moon), distance (50 - 300 meters), target mode (moving vs stationary), target exposure time (10, 20, 30 and 90 seconds), and their interactions on search performance. Author (TAB)

N71-11624*# Wisconsin Univ., Madison. Space Science and Engineering Center.

BALLOON-BORNE RADIO ALTIMETER

Nadav Levanon *In its* Meteorol. Meas. from Satellite Platforms Aug. 1970 p 347-377 refs (See N71-11613 02-20)
Avail: NTIS CSCL 14B

An accurate pulse radar altimeter which is simple and light enough to be carried aloft by a regular sounding balloon is described. The altimeter uses a single superregenerative stage serving as both the receiver and the transmitter. This stage is used in a feedback system in such a way that the period between transmitted pulses is a measure of altitude. The relatively slow rate of change of altitude allows the averaging of many returns with corresponding improvement in signal to noise ratio. Accurate geometric altitude of a meteorological balloon can improve atmospheric sounding. It can also replace either temperature or pressure measurements through the use of the hydrostatic equation. Geometric altitude is essential in floating superpressure balloons, where, together with a pressure measurement, it yields the necessary reference pressure. Analysis of the altimeter and details of the instrumentation are given, along with results of flight tests. Altitudes up to 20 km were measured in balloon flight tests over Lake Michigan. At midrange, the rms value of the random error was smaller than 0.07 percent. Height readings were available every 2 seconds during both the ascent and descent of the balloon payload. The peak power of the altimeter was one watt. Author

N71-11681# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

SYNCHRONIZATION OF DISTANT STATIONS BY SIMPLE OVERFLIGHT: OPERATION SYNFRAL [SYNCHRONISATION DE STATIONS ELOIGNEES PAR SIMPLE SURVOL: OPERATION SYNFRAL]

Jean Besson, Joseph Cumer, Roger Gouillou, and Jacques Zakheim 1970 33 p refs In FRENCH; ENGLISH summary
(ONERA-NT-165) Avail: NTIS

The most accurate means of synchronization are briefly recalled. The simple overflight method is then described, and the equipment used is presented. Results of a synchronization performed in June 1969 between the Paris and Brunswick Observatories, are finally presented. Author (ESRO)

N71-11682# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

MINIATURIZED ELECTRET PRESSURE SENSORS AND ASSOCIATED ELECTRONICS [CAPTEURS DE PRESSION MINIATURES A ELECTRETS ET ELECTRONIQUE ASSOCIEE]

Bernard Baerd, Jacques Beaussier, and Roger Jean 1970 9 p refs In FRENCH Presented at the IMEKO V (Mesucora) Congr., Versailles, France, 25-30 May 1970 Submitted for publication
(ONERA-TP-830; FR-263) Avail: NTIS

A pickup is described having the following characteristics: no high voltage necessary, thickness reduced to 1 mm, unsensitive to vibrations and shocks, relatively inexpensive, resonance frequency 80 to 100 kHz. It has been designed for insertion within compressor blades, but could be used otherwise. Its industrial manufacture is being considered. ESRO

N71-11833# Defense Documentation Center, Alexandria, Va.

INFRARED PHOTOGRAPHY, VOLUME 1 A DDC Bibliography, Jan. 1954-May 1970

Sep. 1970 108 p refs
(AD-712100; DDC-TAS-70-75-1-Vol-1) Avail: NTIS CSCL 14/5

The bibliography contains annotated references on infrared photography and infrared films. Topics include: Aerial surveying, planetary and lunar research, high speed recording with gallium arsenide light emitting diodes, thermal mapping, and technology of infrared radiation. Author (TAB)

N71-11935*# Litton Systems, Inc., Minneapolis, Minn. Applied Science Div.

THE 1969 SOLAR-TRACKER BALLOON FLIGHTS 3051, 3052, 3053, 3054 Final Report

R. D. Conlon Dec. 1969 63 p Prepared for JPL
(Contract NAS7-100)
(NASA-CR-111421) Avail: NTIS CSCL 14B

High-altitude solar cell and radiometer calibrations using balloon techniques are discussed. Solar cell modules and radiometers were flown on balloon-mounted, solar trackers at a nominal 120,000-foot altitude to obtain near zero-air-mass performance data. A total of four balloon flights were attempted. Two flights carried solar cell payloads and two flight attempts were made to obtain solar intensity measurements radiometers. Operational details of these flights, discussion of problems encountered and instrumentation changes accomplished during the program, and tabulations of secondary temperatures, calibration voltages, and time-altitude data recorded during the program are presented. Author

N71-11971# Princeton-Pennsylvania Accelerator, Princeton, N.J. Document Office.

RESPONSE OF A MINERAL-OIL BASED LIQUID SCINTILLATOR TO HEAVILY IONIZING PARTICLES

R. C. Webb, M. G. Hauser, and R. E. Mischke Jun. 1970 21 p refs
(Contract AT(30-1)-2137)
(PPAR-26) Avail: NTIS

The response of a mineral-oil based liquid scintillator to heavily ionizing particles has been determined by measuring the light produced by stopping protons and deuterons. The results are expressed in terms of a saturation parameter which is found to have a value similar to that obtained in a variety of organic scintillators Author (NSA)

N71-11984*# Michigan Univ., Ann Arbor. Willow Run Labs.

MULTISPECTRAL DATA COLLECTION AND INSTRUMENTATION STUDIES

D. S. Lowe *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 2 1969 13 p refs (See N71-11976 02-13)
Avail: NTIS CSCL 20F

Two programs involving multispectral data collection and infrared instrumentation studies are discussed. The C-47 multispectral aircraft used in the studies carries optical mechanical scanners capable of simultaneous collection of imagery in as many as 19 wavelength bands. The various methods of data collection and the results of the program are summarized in tabular form. R.B.

N71-11987*# Arizona Univ., Tucson. Optical Sciences Center.

USE OF PASSBAND INTERFERENCE FILTERS IN MULTISPECTRAL PHOTOGRAPHY

Philip N. Slater and Dean B. McKenney *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 2 1969 18 p refs (See N71-11976 02-13)
(Contracts NAS9-7081; F04695-67-C-0197)
Avail: NTIS CSLC 71H

A type of interference filter is described which can readily be designed for any central wavelength (400 to 900 nm) and any passband width (50 to 350 nm). The filters provide sharper cutoffs and greater efficiency than conventional absorption filters,and total transmittance in the required passbands, is shown to be 2 or 3 times greater, resulting in shorter exposure times and about a twofold increase in spatial resolving power for early space multiband photography experiments. The passband interference filters deposited on flat glass plates can be used to replace conventional absorption filters for lenses of less than 40 deg field of view. For larger angular fields the passband changes in shape and wavelength position. However, by uniformly depositing the filter on a selected lens surface, it is shown that the changes in shape and wavelength position can be greatly reduced for some modern wide-angle aerial lenses. Author

N71-11988*# Long Island Univ., Greenvale, N.Y.

MULTISPECTRAL VIEWERS

Edward Yost *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 2 1969 28 p refs (See N71-11976 02-13)
Avail: NTIS CSCL 17H

Multispectral additive color viewing devices are considered as a practical method for extracting useful information from sets of multiband photography. It is shown that such photography must be of exceptional quality in that the spatial positioning of all images with respect to their principal points must be accurate. Good correspondence is also required between the image densities on all the multispectral photography and the quantity of radiation reflected by an object in that particular spectral band. Author

N71-11989*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

MICROWAVE STUDIES AND INSTRUMENTATION FOR THE EARTH RESOURCES PROGRAM

John C. Blinn, III *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 2 1969 3 p (See N71-11976 02-13)
Avail: NTIS CSCL 17I

Progress is reported on a program to obtain data for calibration of aircraft microwave radiometers, to determine the microwave penetration depth of various materials, to examine the effects of particle size on microwave emission, and to examine the effects of water content on microwave emission. Other field measurement programs include reduction and analysis of data gathered over water, salines, limestone, and sand, and multifrequency radiometric data on various states of the ocean surface. Airborne measurements include microwave radiometry, radar-radiometry for simultaneous active and passive information, and a long-wave imaging radar. R.B.

N71-11990*# Nevada Univ., Reno. NASA Project Office.

GROUND TRUTH/SENSOR CORRELATION

Peter Chapman, Jack Quade, Peter Brennan, and John C. Blinn, III (JPL) *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 2 1969 28 p refs (See N71-11976 02-13)
Avail: NTIS CSCL 17H

The NASA 926 aircraft overflew a ground test site to examine remote sensing applications on simple geologic features. Data were taken by four-channel microwave radiometers, supported by radar scatterometers, thermal infrared imagers, and color infrared photography. During the overflight, intensive ground measurements of the thermal and physical characteristics of the materials at the test site were conducted. The usefulness of various photographic techniques as an aid to interpretation of long wavelength sensor data is discussed. The experiments show that multifrequency microwave techniques permit differentiation of materials on the basis of density, thermal characteristics, and surface roughness. Author

N71-11992*# Geological Survey, Washington, D. C.

RECENT PROGRESS IN TANK, SHIPBOARD, AND HELICOPTER TESTS OF THE FRAUNHOFER LINE DISCRIMINATOR

George E. Stoertz and William R. Hemphill *In* NASA. Manned Spacecraft Center 2D Ann. Earth Resources Aircraft Program Status Rev., Vol. 2 1969 (See N71-11976 02-13) 30 p refs
Avail: NTIS CSCL 20F

The Fraunhofer line discriminator (FLD) is described as an experimental optical instrument for detecting substances that fluoresce near the sodium D2 Fraunhofer line (5890 A). From an airplane, the FLD functions as an airborne fluorometer, quantitatively measuring the concentration of substances in the water that fluoresce near 5890 A (yellow). The concentration of a substance is determined by using quantitative standards. Accurate quantitative measurements require ground-truth data: (1) the turbidity and temperature of the water column sensed by the FLD; and (2) the identity and approximate vertical distribution of the fluorescent substance. Laboratory experiments using tap water show that 1 part per billion (ppb) of Phodamine WT dye dissolved in 1/2 meter of water is detected. Shipboard and helicopter tests indicate the dye can be monitored in concentrations less that 5 ppb. Helicopter tests over relatively clear water suggest that 0.5 ppb can be detected. Fluorometer analysis of water samples collected simultaneously indicate that the FLD is accurate to about 5 percent for the range 1 to 50 ppb. Author

N71-11993*# Barringer Research, Ltd., Dowagiac, Mich.
EXPERIMENTAL RESULTS IN THE REMOTE SENSING OF GASES FROM HIGH ALTITUDES
A. R. Barringer and J. H. Davies *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 2 1969 31 p (See N71-11976 02-13)
Avail: NTIS CSCL 20F

A brief history of correlation spectroscopy is provided. The continuing progress made in the experimental and theoretical development of techniques for remote sensing of trace gases by optical correlation methods is reviewed. The concept of correlation spectrometry has been improved by the use of computer techniques for correlation mask optimization, and the problems of atmospheric scattering are investigated in some detail. Theoretical work is matched against various types of remote-sensing measurements, including long horizontal-path measurements using active light sources and passive remote sensing from aircraft flying above the inversion layer. Good results were obtained in terms of monitoring patterns of pollution and tracking plumes, and methods are being developed for improving the absolute accuracy of measurements. A number of test airborne surveys of pollution were carried out over cities, and a high altitude balloon experiment was conducted. Author

N71-12016# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
PLACEMENT EFFECTS ON GROUND SHOCK INSTRUMENTATION Interim Report
James K. Ingram Jul. 1970 24 p refs Presented at AF Spec. Weapons Center Symp. on Instrumentation for Nucl. Weapons Effects Simulation, 12–13 Mar. 1970 Sponsored by DASA *Its* Misc. Paper N-70-7
(AD-711894) Avail: NTIS CSCL 14/2

During the past decade, numerous explosive field tests have been conducted using a variety of instruments to record ground shock due to dynamic loadings. These instruments have generally been placed sequentially in boreholes which were backfilled using various materials and placement techniques. To assess the influences these techniques can exert on embedded gages, a series of wave propagation tests were conducted as the U. S. Army Engineer Waterways Experiment Station in the Small Blast Load Generator. Four placement techniques were studied to cover a range of placement conditions used in field practice. The first, gage placement concurrent with specimen construction, is applicable only to laboratory or small-scale tests and was used primarily as a reference for the other placement methods. The other methods involved the placement of gages in boreholes and backfilling with the following materials: the excavated in situ material, a property-matching artificial soil, and a dense, rained sand. Because of their sensitivity to placement, primary emphasis was put on soil stress gages. A limited number of motion gages were also used. The results of the study indicated that the borehole material properties must reasonably match those of the local in situ material to ensure that the measurements are truly representative of the actual free-field ground shock. As a result of this study, the artificial soil backfill technique was used for instrument placement in deep field holes on the HEST Test V experiment. Author (TAB)

N71-12053# Advanced Kinetics, Inc., Costa Mesa Calif.
DEVELOPMENT OF A HIGH-CURRENT PROBE Technical Report, Jul. 1967 –Apr. 1968
R. W. Waniek and T. Emil Kirtland AFB, N.Mex. Air Force Spec. Weapons Center Aug. 1970 265 p
(Contract F29601-67-C-0107)
(AD-712048; AFSWC-TR-68-2) Avail: NTIS CSCL 14/2

The program was aimed at the development of wideband probes for the detection of transient currents ranging up to 300,000 amperes generated during the discharge of the AFSWC Kirtland EMP installation. The method adopted for the measurement is based on electromagnetic induction between the magnetic field of the current-carrying conductor and a toroidally wound loop. The theoretical foundations of the method are first examined in general terms. Subsequently, the response is calculated for probes and conductors of arbitrary cross sections by evaluating the surface integrals. Detailed calculations of the response are also carried out for the conductors to be used in the Kirtland EMP installation. The probe is discussed as a part of the complete detecting circuitry. A detailed analysis is presented of the equivalent circuit describing accurately the problems of attenuation, of output impedance, and of passive integration. The results of these analytical studies are used for the engineering design of three probes, each of these being aimed at covering a definite range in current and frequency response. The mechanical design of the probes satisfies these response parameters, the requirement for opening the loop around the conductor and the need for adequate shielding to minimize RFI effects. The response of the probes is studied by using signal generator and high-power pulse testing methods. The results are presented in terms of formulae and descriptive graphs. Author (TAB)

N71-12104# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
USE OF ULTRASONIC METHOD FOR STUDY OF STRUCTURE OF SNOW COVER
Yu. F. Durynin [1970] 6 p refs Transl. into ENGLISH from Vestn. Mosk. Univ., Ser. 5: Geograf. (Moscow), v. 20, no. 5, 1965 p 77–79
(AD-711918) Avail: NTIS CSCL 14/2

The study of the stratigraphic characteristics of the snow cover and its development now is done by visual-instrumental observations in holes in the snow cover. The imperfection and the limitations of the method of making observations in holes has made it necessary to seek other means for making observations and checking on the state of the snow cover. Work was undertaken on the study of the acoustic properties of snow by ultrasonic methods and clarification of the basic and practical possibility of use of this method for study of the structure of the snow layer. Author (TAB)

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N71-11433# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
BONDED JOINTS: A PHOTOELASTIC STUDY
V. Niranjan Jul. 1970 43 p refs
(UTIAS-TN-138) Avail: NTIS

The existing literature on bonded metal-to-metal joints on the stress distributions in the adhesive layers is reviewed. This particular stress distribution is of significance for bonded joints designed to fail in the adhesive, either under static or under fatigue loads. The stress distributions in the metal due to stress concentrations around the bonded joint is studied. It is shown that these high stresses can be reduced in both the adhesive and the metal by means of chamfering the metal edges. Author

N71-11446# Joint Publications Research Service, Washington, D.C.

POSSIBILITY OF GAS EXTRUSION OF MATERIALS

L. F. Vereschagin et al *In its* Substructural Hardening and Gas Extrusion of Metals 22 Oct. 1970 p 25–28 refs (See N71-11444 02-17)
Avail: NTIS

The possibility of using a high-pressure gas medium for extrusion of materials was proved experimentally. The variation in mechanical properties and microstructure of the extruded materials was investigated as a function of the degree of drawing. The force conditions of extrusion were also determined. Characteristic features of mass extrusion and properties of materials extruded by gas at room temperature compare favorably with the hydrostatic extrusion process. E.M.C.

N71-11528# Illinois Univ., Chicago. Dept. of Materials Engineering.

PRINCIPLES OF INCREMENTAL FORGING Final Report, 1 Jan. 1969 – 31 May 1970

P. H. Abramowitz and J. A. Schey Jul. 1970 63 p refs
(Contract N00019-69-C-0158)
(AD-711303; Rept-70-6) Avail: NTIS CSCL 13/8

Plasticine, lead and commercial purity aluminum were demonstrated to be suitable room temperature analog materials for the simulation of hot forging materials such as alloy steels and titanium alloys in axially symmetric upsetting experiments with material overhang. The commercial purity aluminum provided the best combination of reproducible deformation behavior, uniform elongation, availability and cost and was predominantly used as the workpiece material throughout the program. Incremental forging of a thin web-tall rib configuration was successfully performed when side-acting rams cooperating with the main (vertical) anvils were incorporated into the process. Forgings with central (cross) ribs as well as side ribs have been formed with this technique. When vertical anvils were used alone, either the rib height was substantially reduced or material in the web section was simply pushed back and forth as successive indentations were taken. To obtain a more basic understanding of truly free deformation of the rib section, a number of systematic experiments were conducted with a single plane strain indentation in the workpiece. The length of the anvil relative to the instantaneous workpiece height and the rib thickness were found to be primary factors influencing both the mode of deformation of the rib and the indentation pressure. Author (TAB)

N71-11529*# Sterling (Walter V.), Inc., Claremont, Calif.

NONDESTRUCTIVE TESTING OF INTERCONNECTIONS AND MICROJOINTS Final Report

Mar. 1970 67 p refs
(Contract NAS2-4166)
(NASA-CR-73485; WVS-170-2467-06) Avail: NTIS CSCL 13H

The development of nondestructive weld evaluation techniques and instrumentation for ultimate application in the field of high reliability electronic circuit and component welding is reported. The possibility of applying these techniques to the evolution of microjoints in integrated circuits is discussed. Author

N71-11555# Royal Inst. of Tech., Stockholm (Sweden). Div. of Electron Physics.

ELECTRON BEAM SYSTEM FOR THIN FILM EVAPORATION AND WELDING

Jean-Marie Lofo Jun. 1970 14 p refs
(Rept-70-19) Avail: NTIS

Electron beam guns are finding ever-increasing applications for thin film evaporation, fusion welding, melting, and zone refining. The use of highly collimate electron beams as a heat source has numerous advantages over other thermal sources, particularly because of its energy density, controllability, and its compatibility with high vacuum. A general description and the operating principles of a high voltage electron beam system working at a power level of about 1.5 kW and designed and built for both evaporation and welding purposes, is presented. Author (ESRO)

N71-11556# Technical Univ. of Norway, Trondheim. Dept. of Production Engineering and Machine Tools.

ON-LINE STATISTICAL ANALYSIS OF SURFACE ROUGHNESS BY MEANS OF A SMALL DIGITAL COMPUTER

Jan Erik Torjussen Jun. 1969 60 p refs Sponsored by the Norweg. Res. Council for Sci. and Humanities
Avail: NTIS

Principles for measuring surface roughness are given, together with a description of the computer system for statistically analyzing surface roughness. The roughness profile, obtained from a stylus tracer instrument is regarded as a random signal, characterized by the density and distribution functions. The functions and parameters are expressed mathematically and a physical interpretation is given by means of three experiments. The roughness characterizing functions and parameters are summarized and practical applications are suggested. ESRO

N71-11557# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

LIQUID METAL COOLING OF TURBINE BLADES [REFROIDISSEMENT DES AUBES DE TURBINES PAR METAUX LIQUIDES]

Emile Le Grives and Jeanne Genot 1970 21 p refs In FRENCH; ENGLISH summary Presented at the AGARD Meeting on High Temp. Turbines, Florence, 21–25 Sep. 1970 Submitted for publication
(ONERA-TP-872) Avail: NTIS

Mass transfer conditions in thermosiphon or evaporative cycles under high centrifugal acceleration are briefly analyzed. Sodium potassium alloys are shown to be best suited on account of their heat transfer ability with air cooled exchangers at the blade roots. A high rotation speed test setup on which the heat flux on the blades is comparable to that of a real turbine has been extensively used for an experimental study of these processes. Both cycles lead to a temperature drop as high as 650 C at the blade tips, with a mass flow rate of cooling air of 10 g per sec kW. However, several advantages are shown for the evaporative cycle in view of its application to high temperature gas turbine cooling. Author (ESRO)

N71-11558*# American Machine and Foundary Co., Alexandria, Va.

DEVELOPMENT OF A TECHNIQUE FOR FORMING HELICAL COILS Final Report

William E. Stapf 8 Oct. 1970 30 p ref
(Contract NAS5-21125)
(NASA-CR-111400) Avail: NTIS CSCL 13H

Forming techniques for fabricating a 200 turn helical coil for use as the recording surface on a helical tape recorder were studied. The technique selected for fabricating the helical coils was the use of a rolling mill. The tape is fed between two driven rolls and by varying the pressure between the rolls and, changing the angle of the top roll in relation to the bottom roll, tapes of various diameters are formed. Author

N71-11559# Technical Univ. of Norway, Trondheim. Dept. of Production Engineering and Machine Tools.

THE MANUFACTURING SYSTEM CONCEPT. PART 3: SELECTION OF OPTIMUM CUTTING CONDITIONS IN TURNING

Asbjoern Rolstadas Jun. 1969 34 p refs
(Rept-3) Avail: NTIS

A model for rough planing, rough facing, finish planing, and finish facing is described. A general method for solving the problem using a direct search technique is given. The method has been programmed in FORTRAN 4 for the Univac 1107 computer. Execution time for the calculation of one set of cutting data varies from 0.02 to 0.18 seconds. ESRO

N71-11560# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
CONTRIBUTION TO THE STUDY OF THE COLD-DRAWING OF METALLIC MATERIALS [CONTRIBUTION A L'ETUDE DE L'ECROUISSAGE DES MATERIAUX METALLIQUES]
Yves Morchoisne (Ph.D. Thesis—Paris Univ., 23 Oct. 1969) 1970 54 p refs In FRENCH; ENGLISH summary
(ONERA-NT-158) Avail: NTIS

Within the framework of a plastic theory of continuous media, the limit surface evolution of the elasticity domain is predicted and the deformation calculated. Starting from a schematic representation of the behavior at a so-called microscopic scale it has been found, assuming some independences, that knowing two functions may be sufficient to describe the variation of the limit surface. With this description it has been possible to propose an expression of the deformation as a function of the loading history. Each of the three functions characterizing a given material has been determined at least once, and simple tests are proposed to systematize such a determination. The computation accuracy of the deformation has been established in the traction-torsion case. Author (ESRO)

N71-11569*# Bureau of Mines, College Park, Md. Metallurgy Research Center.
FACTORS RELATED TO MINERAL SEPARATION IN A VACUUM
Foster Fraas Jun. 1970 17 p refs
(NASA Order R-09-040-001)
(NASA-CR-111399; BM-RI-7404) Avail: NTIS CSCL 13H

Under a very high vacuum of 10 to the minus 8th power torr the transfer of terrestrial mineral beneficiation methods to the vacuum ambient of extraterrestrial locations such as the lunar surface was investigated. In the size range for the electrostatic and magnetic separation of ores (minus 35 plus 150 mesh) there is no adhesion of particles produced by crushing and grinding due to the limited contact area, and for repeated contacts area size has a frequency of occurrence in accordance to the normal law. The photoelectric effect which is successful in separating a few minerals in an air ambient has a wider application in a vacuum, while the lack of air viscosity and sound transmission provides for high feed velocities and the adaptation of particle vibration to dispersion and grinding. Contact electrification is reversible upon return to atmosphere. Author

N71-11570# Royal Aircraft Establishment, Farnborough (England).
FRICTION AND LEAKAGE LOSSES OF PISTON RINGS. PART 1: THE BEHAVIOUR OF PISTON RINGS IN THE HYDRAULIC CYLINDERS OF OIL HYDRAULIC ACTUATORS. PART 2: AN INVESTIGATION OF THE BEHAVIOUR OF PISTON RINGS IN THE HYDRAULIC CYLINDERS OF OIL HYDRAULIC ACTUATORS WITH EXPERIMENTAL RESULTS [REIBUNG UND LECKVERLUSTE VON KOLBENRINGEN. TEIL 1: VERHALTEN VON KOLBENRINGEN IN HYDROZYLINDERN VON OELHYDRAULISCHEN VORSCHUBANTRIEBEN. TEIL 2: UNTERSUCHUNGEN UEBER DAS VERHALTEN VON KOLBENRINGEN IN HYDROZYLINDERN VON OELHYDRAULISCHEN VORSCHUBANTRIEBEN UND VERSUCHSERGEBNISSE]
C. M. Lang Jun. 1970 47 p refs Transl. into ENGLISH from Maschinenmarkt (Wuerzburg), v. 74, no. 27, 1968 p 448–452 and no. 62, 1969 p 1231–1238
(RAE-Lib-Trans-1455) Avail: NTIS

The friction and leakage behaviour of lightly tensioned piston rings are studied with overlapped gaps, and it has been shown to what extent advantage is gained in the form of greater efficiency by the use of several rings. In the case of piston rings, friction and leakage are not, as in the case of closed elastic rubber packings, inversely relationed to each other. The leakage depends almost exclusively on the flow around the piston rings introduced via the gap. The loss of oil from the running surface is, on the other hand, small. The friction of piston rings is affected by the gap position and gap size, by the velocity, by pressure and counter-pressure levels, by pressure drops at the piston, by the temperature, and also by the roughness, entry-conditions, and surface treatment of the sliding surfaces. By means of the so-called relieving rings, it is possible to diminish the friction without reducing the sealing effect. Good sealing is, however, only obtained with a piston ring when this is situated on the side of the groove remote from the pressure. The results of investigations into friction and leakage in piston rings of various kinds, and the dependence of the friction and leakage on the velocity, pressure and pressure difference across seal, oil temperature and oil viscosity, ring gap position and ring gap size, axial play of the rings in the piston ring groove, and entry condition of the sliding surfaces, as well as on the number and position of the piston rings, are given. Author

N71-11571# Royal Aircraft Establishment, Farnborough (England).
THE EFFECT OF FLOW ON INTERCONNECTED THRUST BEARINGS
D. Faddy Jan. 1969 29 p refs
(RAE-TR-68302) Copyright. Avail: NTIS

In self pressurised gas bearings with cylindrical journals and opposed spiral grooved thrust plates, the thrust plates are frequently placed at opposite ends of the journal bearing. The effect of flow along the journal on the thrust stiffness of this type of bearing assembly is shown to be important in some cases. A comparison with some experimental results is included. Author

N71-11572# Royal Aircraft Establishment, Farnborough (England).
CONSTRUCTIONAL PROCEDURE FOR THE INSERTION OF PISTON RINGS: POSSIBILITIES FOR REDUCTION OF LEAKAGE LOSS AND FRICTION [KONSTRUKTIVE MASSNAHMEN BEIM EINSATZ VON KOLBENRINGEN: MOEGLICHKEITEN ZUR VERMINDERUNG VON LECKVERLUST UND REIBUNG]
C. M. Lang Apr. 1970 34 p refs Transl. into ENGLISH from Maschinenmarkt (Wuerzburg), v. 74, no. 80, 1968 p 1547–1555
(RAE-Lib-Trans-1457) Avail: NTIS

This article shows the designer various precautions and possibilities which may lead to the reduction of leakage losses, friction, and sealing compression of piston rings, and the adaption of these to the sealing problem. The desired effect on the characteristic sealing quantities, which depend upon numerous relevant factors, requires an accurate knowledge of the sealing process, and of the relevant parameters. In various regions of oil hydraulics, different types of demands are made on the application of piston rings. In the case of rotating machine tools, for example, a high degree of positional control of the hydraulic actuating equipment, with the best possible sealing, is required, while in the case of oil-hydraulic presses greater attention is paid to low sealing friction and the possibility of restricting at high pressures the sealing compression by the use of several piston rings. Author

N71-11579*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESIGN STUDY OF SHAFT FACE SEAL WITH SELF-ACTING LIFT AUGMENTATION. 2: SEALING DAM
John Zuk, Lawrence P. Ludwig, and Robert L. Johnson Washington Nov. 1970 29 p refs
(NASA-TN-D-7006; E-5796) Avail: NTIS CSCL 11A

Analytical studies made on a 6.50-inch nominal dam diameter seal with sealed pressure to 315 psia revealed that a shaft face seal with self-acting lift pads can be designed to yield low leakage and positive sealing face separation. The study showed that the leakage flow through the sealing faces can become choked at pressure ratios as low as 4 to 1 for typical seal operating film thicknesses. Slight angular deformations of the sealing faces had a significant effect on the pressure gradient within the sealing faces; thus, seal force balance was correspondingly affected. For sealing faces having angular deformation, the radial width of the sealing dam was found to markedly affect the seal force balance. Author

N71-11583# Technische Hochschule Darmstadt (West Germany). Inst. fuer Werkstoffkunde.

CAVITATION AND CORROSION. DESTRUCTIVE EFFECTS ON A MATERIAL SURFACE AT REST DUE TO THE LIQUID CAVITATION CAUSED BY AN OPPOSITE OSCILLATING PLATE: INVESTIGATIONS ON AN OSCILLATOR [KAVITATION UND KORROSION. ZERSTOERUNGEN AN EINER BEWEGUNGSFREIEN WERKSTOFFOBERFLAECHE DURCH DIE VON EINER GEGENUEBERGESTELLTEN SCHWINGENDEN FLAECHE ERZEUGTE FLUESSIGKEITSKAVITATION: UNTERSUCHUNGEN AM SCHWINGGERAET]

Heinrich Weiser (Ph.D. Thesis) Feb. 1970 70 p refs In GERMAN Sponsored in part by Forschungsver. Verbrennungskraftmaschinen and Wirtschaftsmin.
Avail: NTIS

Damages due to cavitation corrosion in diesel engines occur on the cooling water side of cylinder liners, as well as on motionless motor housing parts facing oscillatory sleeve surfaces. The factors determining damage cannot be gained from practice and are investigated for a model, generating cavitation flow between an oscillating surface and a surface at rest. ESRO

N71-11584# Technische Hochschule Darmstadt (West Germany). Inst. fuer Werkstoffkunde.

CAVITATION AND CORROSION (FIGURES). DESTRUCTIVE EFFECTS ON A MATERIAL SURFACE AT REST DUE TO THE LIQUID CAVITATION CAUSED BY AN OPPOSITE OSCILLATING PLATE: INVESTIGATIONS ON AN OSCILLATOR [KAVITATION UND KORROSION (BILDANHANG). ZERSTOERUNGEN AN EINER BEWEGUNGSFREIEN WERKSTOFFOBERFLAECHE DURCH DIE VON EINER GEGENUEBERGESTELLTEN SCHWINGENDEN FLAECHE ERZEUGTE FLUESSIGKEITSKAVITATION: UNTERSUCHUNGEN AM SCHWINGGERAET]

Heinrich Weiser (Ph.D. Thesis) Feb. 1970 31 p In GERMAN Sponsored in part by Forschungsver. Verbrennungskraftmaschinen and Wirtschaftsmin.
Avail: NTIS

For abstract see N71-11583.

N71-11597# Bureau of Reclamation, Denver, Colo.

THE ELECTROCHEMICAL METHODS OF PROTECTING HYDROTURBINES AGAINST CAVITATION EROSION [OB ELEKTROKHIMICHESKIKH METODAKH ZASHCHITY GIDROTURBIN OT KAVITATSIONNOI EROZII]

N. I. Pylaev et al Oct. 1969 16 p refs Transl. into ENGLISH from Energomashinostr. (Moscow), v. 14, no. 2, 1968 p 26–28 (PB-193658T; Trans-823) Avail: NTIS CSCL 11F

Recently, in the turbines of some hydroelectric power plants, the electrochemical method of protection from cavitation erosion has been applied on an experimental basis. This method consists in simultaneous use of protective zinc paint and cathode protection from an external source of direct current. However, under the conditions of turbine operation, it is difficult to estimate the effectiveness of electrochemical protection in view of the change in operating conditions of the turbine and also the application of various materials to repair services destroyed by cavitation. Accordingly, careful laboratory experiments were conducted to study the effectivenss of this cathode protection. Author (USGRDR)

N71-11627# Rolls-Royce, Ltd., Bristol (England). Manufacturing Development Dept.

ADVANCED MANUFACTURING TECHNOLOGY IN MODERNJET ENGINES

A. H. Meleka *In* AGARD Advanced Technol. for Production of Aerospace Eng. Sep. 1970 5 p (See N71-11626 02-28)
Avail: NTIS

Improved manufacturing technology in aerospace industry encompasses a wide array of methods and processes from value engineering analyses to applied metal working techniques. Special emphasis is placed on metal forming, part joining, electrochemical machining, and electron beam welding methods. Also stressed are the nondestructive tests that find application during the production process. D.G.

N71-11628# Rolls-Royce, Ltd., Bristol (England). Bristol Engine Div.

THE EFFECT OF VALVE ENGINEERING ON AERO-ENGINE DESIGN AND MANUFACTURE

D. G. Iles *In* AGARD Advanced Technol. for Production of Aerospace Eng. Sep. 1970 13 p (See N71-11626 02-28)
Avail: NTIS

A description of the salient points in the value engineering technique is given and its aims and objectives are outlined. Unnecessary costs are identified and the process for their elimination through the job plan is described. The three phases of value engineering in practice are discussed and results of value engineering applications are demonstrated by case studies and a description how the solutions were developed. The value engineering appreciation training scheme adopted by Rolls Royce and how it achieved success is also depicted. Author

N71-11634# Alfa Romeo S.p.A., Naples (Italy).

CONTROL OF HYDROGEN ABSORPTION IN ELECTRO-PLATING PROCESSES

G. Jervolino and F. Brandolini *In* AGARD Advanced Technol. for Production of Aerospace Eng. Sep. 1970 12 p refs (See N71-11626 02-28)
Avail: NTIS

Several different techniques for the control of hydrogen absorption in metals are outlined and their advantages and disadvantages are discussed. Investigations indicate hydrogen absorption may be controlled in metals by decreasing the exposure temperature. A hydrogen probe was also developed to aid in measuring absorption in the electroplating process. E.H.W.

N71-11637# Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Paris (France). Div. Hispano Suiza.

ELECTROLYTIC RECTIFICATION: APPLICATION IN THE AERONAUTICS INDUSTRY [LA RECTIFICATION ELECTROLYTIQUE: APPLICATIONS DANS L'INDUSTRIE AERONAUTIQUE]

J. Poyau and P. Rame *In* AGARD Advanced Technol. for Production of Aerospace Eng. Sep. 1970 17 p (See N71-11626 02-28)
Avail: NTIS

The removal of metal components by electrolysis shows promise for overcoming some of the problems encountered in using aeronautical parts in electrolytes. In the case of electrolyte rectification, methods and techniques were developed to give descriptions of the components on the basis of this discovery. The industralization procedure is effective on different motor parts, rotating machine blades and shafts. The material is a combination of refractory, steel, and sintered alloys and is free of burns, cracks, and superficial constraints. The action of the electrolyte is localized in the work zone. The state of the surface obtained and the precision of the surface depends on the quality of the work surface of the rotating electrode. Transl. by E.H.W.

N71-11638# Societe Microfusion, Paris (France).

CONTRIBUTION OF FOUNDRY PRECISION IN THE

DOMAIN OF AERONAUTICAL TURBINES [APPORT DE LA FONDERIE DE PRECISION DANS LE DOMAINE DES TURBINES AERONAUTIQUES]

R. Cameo *In* AGARD Advanced Technol. for Production of Aerospace Eng. Sep. 1970 12 p ref (See N71-11626 02-28)
Avail: NTIS

The influence of foundry precision in alloys used for the fabrication of aeronautical turbine blades is discussed. A description of the interior forms and cooling points of the turbine blades is given. The results obtained in the models of cylinder wheels for a special duty machine answer the need of motors in the aeronautical domain. Transl. by E.H.W.

N71-11639# TRW, Inc., Cleveland, Ohio.

A COMPARISON OF HIGH ENERGY RADIOGRAPHIC TECHNIQUES FOR LARGE DIAMETER TITANIUM BILLETS

F. J. Sattler *In* AGARD Advanced Technol. for Production of Aerospace Eng. Sep. 1970 15 p refs (See N71-11626 02-28)
Avail: NTIS

Radiographic techniques for billets up to 17 inches in diameter were established in the programs since some engine disks will be forged from the larger diameter billets. Two high energy radiographic units were investigated for this application. A commercial linear accelerator and a betatron were used to analyze the effects of various lead screen, film, and geometry combinations on image sensitivity. Standard radiographic penetrameters were employed for evaluating the radiographic procedures. The inspection method resolved a 40 thousandths inch diameter by 40 thousandths inch deep hole through 17 inches (432 millimeters) of titanium. Various data are illustrated which reveal the effects of front and back lead screen thickness on exposure and resolution. The utility of each unit is discussed in view of the achievable resolution and the economics of the radiographic procedures. Author

N71-11640# General Motors Corp., Indianapolis, Ind. Allison Div.

NEUTRON RADIOGRAPHY

David J. Mallon *In* AGARD Advanced Technol. for Production of Aerospace Eng. Sep. 1970 16 p refs (See N71-11626 02-28)
Avail: NTIS

To permit operation at higher turbine inlet temperatures, first stage turbine blades are cast with internal cooling air passages. Examination of some blades returned from the field or at overhaul bases have revealed foreign material in the air cooling passages. In a few cases this blockage has caused overheating and fracture. The foreign material has been analyzed and found to be core material resulting from incomplete leaching of the core after the blade has been cast. A research program was undertaken to find a nondestructive inspection method that would ensure no residual core was present. The relatively new technique of using neutron exposure of radiographic film was tried and found capable of detecting 1 milligram of residual core material in a blade. Economic analyses showed that blades could be examined for approximately one dollar each on a production basis. Author

N71-11641# Motoren- und Turbinen-Union Muenchen G.m.b.H. (West Germany).

X-RAY FLUORESCENCE ANALYSIS AS AN AID TO PRODUCTION AND REPAIR OF AIRCRAFT ENGINES

Harald Simon *In* AGARD Advanced Technol. for Production of Aerospace Eng. Sep. 1970 14 p (See N71-11626 02-28)
Avail: NTIS

X-ray fluorescence is a relatively new analytical technique which is reliable, versatile and economic, and is therefore findig increasing use in industry. The technique uses X-ray radiation of the specimen to cause excitation and produce fluorescence which is scanned by a monochromator, measured by detectors, amplified and recorded. The technique identifies and estimates the elements which are sought. Examples of the applications of this versatile analytical tool are: (1) Analysis of raw materials, fuels, chemical processing solutions and metal finishing compounds; (2) inspection of components at overhaul; and (3) detection and correction of manufacturing defects. Author

N71-11642# Avco Corp., Lowell, Mass. Avco Systems Div.

NONDESTRUCTIVE TESTING TECHNIQUES FOR ADVANCED COMPOSITES

E. A. Proudfoot *In* AGARD Avanced Technol. for Production of Aerospace Eng. Sep. 1970 17 p refs Supported by the AF (See N71-11626 02-28)
(AVSD-0023-70-PP) Avail: NTIS

Quantitative nondestructive properties measurement procedures used in process development, process control, and acceptance inspection concentrated on means to measure properties of engineering significance for composite and other materials, either directly or indirectly through semi-empirical or empirical correlations. Work was directed at the nondestructive determination of mechanical properties of composites, such as tensile, compressive, flexure, and polar moduli and strengths, and includes a section dealing with determination of reinforcement/matrix volume fractions. This is accomplished through quantitative measurement of the velocity of sound at ultrasonic frequencies and of gamma ray absorption, the use of these measurements separately and in combination, and the application of relatively simple equations taken from physics and micromechanics. The nondestructive results are correlated with destructive test results to provide calibration curves for the particular material. Proper accomplishment of these procedures enables prediction, with better than 90 percent confidence, of moduli to within about 10 percent, of strength parameters to within 10 to 20 percent and volume fractions of major constituents to within about 3 percent. Author

N71-11643# Southwest Research Inst., San Antonio, Tex.

RECENT ADVANCES IN MAGNETIC FIELD METHODS OF NONDESTRUCTIVE EVALUATION FOR AEROSPACE APPLICATIONS

C. G. Gardner and J. R. Barton *In* AGARD Advanced Technol. for Production of Aerospace Eng. Sep. 1970 11 p refs (See N71-11626 02-28)
(Contracts AF 49(638)-1502; NOw-66-0714-d; NOw-66-0209-f)
Avail: NTIS

Three magnetic field nondestructive evaluation methods are under development at: (1) magnetic field perturbation; (2) injected electric current perturbation; and (3) stress measurement by means of the Barkhausen effect. The MFP method, applicable to ferromagnetics, involves scanning the surface of a magnetized specimen with a small, sensitive magnetometer. The resultant magnetic field map reveals certain surface and subsurface flaws. Highly automated MFP system have been developed for inspection of critical load bearing members for manufacturing flaws and fatigue damage. The IECP method, applicable to nonferromagnetic electrically conductive materials, also involves sensing magnetic field anomalies, but differs essentially from MFP in that the field anomalies sensed are associated with flaw-induced irregularities in an electric current distribution established in the specimen. The potential of this method for inspection of aluminum, titanium, and other refractory alloy components has been established. The term Barkhausen effect refers to discontinuous jumps occurring during magnetization of ferromagnetics. Mechanical stress, applied or residual, results in characteristic changes in this process. Prototype stress-measuring instrumentation based upon this effect has been developed and is being evaluated. Presently existing and potential future aerospace application of these three methods are discussed. Author

N71-11644# Motoren-und Turbinen-Union Muenchen G.m.b.H. (West Germany).

ELECTRON BEAM WELDING OF HIGH-DUTY ROTATING

ENGINE PARTS
Wolfgang Hansen *In* AGARD Advanced Technol. for Production of Aerospace Eng. Sep. 1970 12 p (See N71-11626 02-28)
Avail: NTIS

Two examples are used to describe the procedure which can be used to investigate the suitability of electron beam welding on rotating components. After welding of a turbine disc, residual stresses were measured which exceeded half of the ultimate strength. The weld joint between a turbine disc and a shaft could be considerably improved by specific heat treatments. From the experiences accumulated up to now, some rules for the design engineer are derived and illustrated. Author

N71-11645# Societe Turbomeca, Tarnos (France).
UTILIZATION OF ELECTRONIC BOMBARDMENT FOR SOLDERING DIVERSE PIECES OF TURBO-MOTORS AND TURBO-REACTORS [UTILISATION DU BOMBARDEMENT ELECTRONIQUE POUR LE SOUDAGE DE DIVERSES PIECES DE TURBO-MOTEURS ET TURBO-REACTEURS]
B. de Barberin *In* AGARD Advanced Technol. for Production of Aerospace Eng. Sep. 1970 14 p In FRENCH (See N71-11626 02-28)
Avail: NTIS

Electronic bombardment was utilized in industrial work to fabricate turbomachine parts. Examples presented include gear cases, a flux rectifying device, and distributors. The advantages of the procedure are also included. Transl. by E.H.W.

N71-11646# Werkspoor N.V., Amsterdam (Netherlands).
PRODUCTION TECHNIQUE AND METALLURGICAL ASPECTS OF VACUUM BRAZING
R. Kruithof and T. Van Schaik *In* AGARD Advanced Technol. for Production of Aerospace Eng. Sep. 1970 15 p (See N71-11626 02-28)
Avail: NTIS

Discussed are production methods and production techniques of brazing components of different types of industries. Various applications of brazing joints are presented. Brazing processes and equipment are mentioned. Among those processes discussed are vacuum brazing and brazing in a reducing gas atmosphere. Some of the metals and alloys applied in brazing exhibit metallurgical phenomena which influence the behaviour of brazed joints and in some cases necessitate special procedures. Phenomena as carbide precipitation and diffusion in base metal and filler metal are discussed. Author

N71-11647# Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Corbeil (France).
INTRODUCTION OF THE ECM IN THE AERONAUTICS INDUSTRY [INTRODUCTION DE L'E.C.M. DANS L'INDUSTRIE AERONAUTIQUE]
G. Foucher *In* AGARD Advanced Technol. for Production of Aerospace Eng. Sep. 1970 8 p In FRENCH (See N71-11626 02-28)
Avail: NTIS

After a rapid presentation of procedure and different types of machines, some technological definitions on the concepts and utilization of cathodes, fixtures, elements, and the different problems encountered in this technique are given. Particular attention is given to the problem of lowering fatigue limits and the average of restoring it in some of the elements. Transl. by E.H.W.

N71-11648# Societe Turbomeca, Bordes (France).
FLUOTOURNAGE IN THE FABRICATION OF PIECES OF TURBO-MACHINES [LE FLUOTOURNAGE DANS LA FABRICATION DES PIECES DE TURBOMACHINES]
J. Piriou *In* AGARD Advanced Technol. for Production of Aerospace Eng. Sep. 1970 9 p In FRENCH (See N71-11626 02-28)
Avail: NTIS

A lathe is utilized as a means of producing in series a number of turbomachine parts. The photographs presented show the possibilities of extending the fabrication procedure to produce hollow cone shaped parts and cylindrical or evoluted forms. Transl. by E.H.W.

N71-11649# Maxwell Labs., Inc., San Diego, Calif.
ELECTROMAGNETIC PULSE FORMING
Don A. Williams, Jr. *In* AGARD Advanced Technol. for Production of Aerospace Eng. Sep. 1970 16 p (See N71-11626 02-28)
Avail: NTIS

Presented is a brief summary of EMF process principles, starting with the basic interaction of the magnetic fields produced by two electrical currents. The three basic processes - compression, expansion, and flat-forming - are described in terms of magnetic field interactions. The process is then described by analogy with a specially constrained hydraulic force. A brief summary of key process characteristics is then given, followed by a number of examples of typical forming operations which have been accomplished on both laboratory and production base. A brief summary of energy storage and control units and complementary magnetic pulse work coils which are currently in commercial use is included. Author

N71-11650# Vereinigte Flugtechnische Werke G.m.b.H., Bremen (West Germany).
MODERN JOINING METHODS IN THE AIRCRAFT AND AEROSPACE INDUSTRY
Lutz Dorn *In* AGARD Advanced Technol. for Production of Aerospace Eng. Sep. 1970 20 p refs (See N71-11626 02-28)
Avail: NTIS

The present day demand in aerospace technology is for ultra light structures. However, its realisation for the welding engineer poses at least two problems: the most recently introduced high strength materials have more or less unfavourable welding properties; the strength of the welded joint in optimised structures should be approximate to that of the base metal. These problems were solved by improving conventional welding methods and by introducing new methods. Several different types of welding techniques are described and their advantages and disadvantages discussed. Results show electron beam welding to have the least amount of welding damage, best protection from contamination of weld area, and it can easily be used for integral welding. Applications of welding techniques to aerospace structures are also discussed. Author

N71-11651# Kloeckner-Humboldt-Deutz A.G., Oberursel (West Germany).
APPLICATION OF JOINING METHODS AND TREATMENT OF METAL SURFACES TO IMPART IMPROVED CORROSION RESISTANCE AND DIMENSIONAL BUILD-UP IN ENGINE PRODUCTION
Karl Schreck *In* AGARD Advanced Technol. for Production of Aerospace Eng. Sep. 1970 9 p refs (See N71-11626 02-28)
Avail: NTIS

Examples of some applications of electron beam welding and plasma jet spraying are given. High temperature vacuum brazing is demonstrated on some of the examples. Also described is the HAE and pre-treatment for corrosion prevention in magnesium components. E.H.W.

N71-11652# Sundstrand Corp., Rockford, Ill.
COMPUTER-AIDED MANUFACTURING AND NUMERICAL CONTROL IMPACT ON MANAGEMENT DISCIPLINES
A. E. Hermanson and C. M. Bourdain *In* AGARD Advanced Technol. for Production of Aerospace Eng. Sep. 1970 5 p (See N71-11626 02-28)
Avail: NTIS

A computer based system is being developed which seeks to integrate the work of design with the generation of control tapes

for manufacture by numerically controlled machine tools. The scheme is to be used: (1) For the analysis of stress etc. (the long term objective) and more immediately: (2) To produce drawing and solve problems for the draftsman. (3) To produce instructions for manufacture on n/c machines. A film was produced which seeks to explain the unfamiliar ideas and introduce the unfamiliar hardware. The hope is that the film will give a good overall picture to both management and potential users and thus allow them to concentrate on the essential simplicity of the scheme in use.
Author

N71-11675# Battelle Memorial Inst., Columbus, Ohio.
A STUDY OF THE MECHANICS OF CLOSED-DIE FORGING Final Report, Jun. 1968 - Jun. 1970
T. Altan, A. F. Gerds, D. E. Nichols, H. J. F. Henning, and R. J. Lorentino Aug. 1970 191 p refs
(Contract DAAG46-68-C-0111)
(AD-711544; AMMRC-CR-70-18) Avail: NTIS CSCL 13/8

The objectives of the manufacturing improvement program was to establish the applications and limitations of analytical approaches in closed-die forging. The study has been concerned mainly with the study of mechanics and interactions of important variables related to the workpieces, the dies, and the equipment selected for forging. Three industrial forging companies participated in the program in conducting forging trials using presses instrumented to determining loads, stresses, and energies used in forging various parts so that correlations between predicted and actual data could be made. Quantitative assessments were made of deformation rates, temperatures, flash geometries, part shapes, materials, and forces required in the forging of aluminum, steel, and titanium parts.
Author (TAB)

N71-11699# Martin Marietta Corp., Denver, Colo. Center for High Energy Forming.
[HIGH ENERGY FORMING RESEARCH] Quarterly Technical Progress Report, 1 Apr. - 30 Jun. 1970
Jimmy D. Mote Watertown, Mass. AMRA 1 Jul. 1970 27 p refs Prepared in cooperation with Denver Univ., Colo.
(Contract DA-19-066-AMC-266(X); ARPA Order 720)
(AD-711568; AMRA-CR-66-05/23; QTPR-20) Avail: NTIS CSCL 13/8

The report summarizes results of the following studies: Measurement of the dynamic loads on an explosive forming die; Applications of explosive welding to hardware configuration; Flange buckling of explosively formed domes; Explosive punching of dual hardness armor; Cylindrical explosive forming dies; Explosive forming of domes in vented dies; Explosive forming of domes for ground based pressure vessels; Pull-in of explosively formed domes; Fracture toughness of explosively formed high strength steel; Terminal properties of titanium; Explosive welding; Explosion welding of dual hardness armor; Explosive powder compaction; Explosive forming of thick plates; Theoretical studies of explosive energy transfer to a thick walled cylinder using a radial piston.
Author (TAB)

N71-11701*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPACE PROCESSING AND MANUFACTURING
21 Oct. 1969 544 p refs Conf. held at Huntsville, Ala., 21-22 Oct. 1969
(NASA-TM-X-66480; ME-69-1) Avail: NTIS CSCL 13H

Conference papers are presented on space manufacturing techniques and materials development for orbital workshops. For individual titles see N71-11702 through N71-11732.

N71-11703*# American Optical Co., Southbridge, Mass.
GLASS PREPARATION IN SPACE
Emil W. Deeg *In* NASA. Marshall Space Flight Center Space Process. and Manufacturing 21 Oct. 1969 p 41-58 refs (See N71-11701 02-15)
Avail: NTIS CSCL 13H

Low gravity, ease of access to high energy radiation and to high vacuum are conditions making an earth orbiting laboratory unique for developing new glass making processes. Among them are crucible free melting, preparation of glasses sensitive to thermal convection, formation of lenses and mirror blanks with fire polished surface directly from the melt, formation of dispersion filters, ruby glasses and glass-ceramics requiring nucleation control through solid powder dispersion. Advantages of these methods and difficulties to be expected in performing the first experiments will be discussed.
Author

N71-11705*# Grumman Aerospace Corp., Bethpage, N.Y.
BORON FILAMENT MANUFACTURE IN SPACE: A LITERATURE FEASIBILITY STUDY
David Kloepper and Robert Witt *In* NASA. Marshall Space Flight Center Space Process. and Manufacturing 21 Oct. 1969 p 79-114 refs (See N71-11701 02-15)
Avail: NTIS CSCL 13H

Presented is a comprehensive review of technical literature pertaining to the manufacture of boron filament on Earth. A possible space manufacturing process for boron filament is described. Several central substrate deposition techniques, using different core materials, electric decomposition, and other boron-containing raw materials, are discussed. Nonsubstrate deposition techniques, such as glow discharge on a rotating disc or between two pointed tungsten electrodes, are described. Several techniques to manufacture boron filament from the melt are discussed. These include point destruction of surface tension, electrical discharge forming, melt drawing, Czochralski crystal growth, the Taylor process, drawing a substrate through a melt, and melt extrusion. This survey points out a way to manufacture boron filament in space that involves heating high-purity boron to 2800 F in boron nitride crucibles, and then transferring it into an RF-positioning field for further heating by induction coils or hot gas.
Author

N71-11706*# General Electric Co., Philadelphia, Pa.
WEIGHTLESS, CONTAINERLESS MELTING AND SOLIDIFICATION OF POTENTIAL NEW METAL AND CERAMIC PRODUCTS
R. T. Frost *In* NASA. Marshall Space Flight Center Space Process. and Manufacturing 21 Oct. 1969 p 115-134 (See N71-11701 02-15)
Avail: NTIS CSCL 13H

A number of suggestions have been made for the weightless processing in space of metals and ceramics. The most obvious application of a weightless environment is the removal of buoyancy forces in multi-phase systems and the possibility for containerless melting and solidification processes. Under the first category, processes which can be considered are the casting of superalloy materials containing rare earth oxide inclusions and the casting of metal emulsions where convection currently leads to phase segregation. Under containerless processing we can consider extensions and scale up of processes which have been studied in terrestrial levitation experiments. Possible applications are the preparation of ultrapure materials and solidification under conditions of extreme subcooling.
Author

N71-11708*# North American Rockwell Corp., Downey, Calif.
POSSIBILITIES FOR PRODUCING NEW GLASSES IN SPACE
R. A. Happe *In* NASA. Marshall Space Flight Center Space Process. and Manufacturing 21 Oct. 1969 p 146-175 refs (See N71-11701 02-15)
Avail: NTIS CSCL 13H

Zero gravity melting permits the elimination of a solid container during both the melting and cooling phases of glass production. The combination of superheating well above the melting temperature and cooling in the absence of most normal nucleation sites promises to permit the production of glasses from normally crystalline materials such as Al_2O_3, HfO_2, ZrO_2, etc. Such glasses should find immediate applications in refractive optics, where the unusual combinations of index of refraction and dispersion can be used to advantage in highly corrected multi-element lenses. The possibilities for returning supercooled liquids as glasses from orbit and growing single crystals on earth is discussed. Heating equipment and atmospheres for space melting of glasses are considered. Author

N71-11709*# Revere Coppper and Brass, Inc., Rome, N.Y.
ALUMINUM AND ALUMINUM OXIDE IN ZERO GRAVITY
L. F. Mondolfo *In* NASA. Marshall Space Flight Center Space Process. and Manufacturing 21 Oct. 1969 p 176-182 refs (See N71-11701 02-15)
Avail: NTIS CSCL 13H

An experiment is described to test the feasibility of using absence of gravity to mix immiscible materials. The mixing of aluminum oxide into molten aluminum has been chosen, as representative of the dispersing of immiscible solids into liquids. The equipment planned consists of a small self-contained furnace burning a Thermit mixture, which can handle some 100 grs. of metal. One of two results is expected: (1) mixing is successful; and (2) freezing produces separation. In either case, industrial exploitation is to be expected. Author

N71-11710*# TRW Systems Group, Redondo Beach, Calif.
REDUCED GRAVITY PROCESSING OF HOMOGENIZED IMMISCIBLE METAL ALLOYS
J. L. Reger, M. E. Kirkpatrick, and R. L. Hammel *In* NASA. Marshall Space Flight Center Space Process. and Manufacturing 21 Oct. 1969 p 183-194 refs (See N71-11701 02-15)
Avail: NTIS CSCL 13H

Reduced gravity material experiments to process and prepare unique metal alloy systems from normally immiscible liquid phase melts are described. The study of this previously unclassified group of materials is considered from several aspects. The effects of low gravity environment on the observed immiscibility limits of two phase liquid combinations are considered. Included are discussions of homogenized alloy processing covering production of materials with unique physical and electrical properties, consideration of basic solidification processes, and the potential application of homogenized alloys in the preparation of composite materials. Author

N71-11712*# General Electric Co., Philadelphia, Pa.
UNIT SEPARATION PROCESSES IN SPACE
L. R. McCreight and R. N. Griffin *In* NASA. Marshall Space Flight Center Space Process. and Manufacturing 21 Oct. 1969 p 216-237 refs (See N71-11701 02-15) Avail: NTIS CSCL 13H

Some unit separation processes used for purifying chemicals and biologicals (vaccines) are clearly affected by the earth's gravity and therefore might be improved by operation in space. Centrifugation and electrophoresis are the prime examples of such processes. Meanwhile other processes such as freeze drying and ultraviolet sterilization are desirable adjuncts in a spectrum of processes that could permit the complete preparation of vaccine or other materials in space. The freeze drying operation would take advantage of the low temperatures and vacuum of space. These processes are being considered as a spectrum of interrelated processes that could lead to the complete preparation of vaccine or to the preparation of materials to be used in other processes and products. Author

N71-11715*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METALS MELTING AND EXOTHERMAL HEATING
Robert V. Hoppes *In its* Space Process. and Manufacturing 21 Oct. 1969 p 262-270 (See N71-11701 02-15)
Avail: NTIS CSCL 13H

Two of the experimental tasks approved as part of M512 space experiment are metals melting (electron beam welding) and exothermal heating (tube brazing). The two tasks have similar objectives: (1) to learn about the behavior of molten metal in a reduced gravity environment; (2) to demonstrate two heat sources for melting materials in space; and (3) to establish a method of joining and repairing. Four materials will be used in the first task: SS, Ti, Al, and TDNi. A beam of constant power density will impinge on a revolving plate with a melt circle diameter of seven inches. In the second task, sixteen SS tubes will be joined by brazing, using exotherm heat sources. Author

N71-11716*# Little (Arthur D.), Inc., Cambridge, Mass.
SPHERICAL FORMING AND COMPOSITE CASTING IN ZERO g
A. E. Wechsler, J. Berkowitz-Mattuck, P. C. Johnson, and L. B. Griffiths *In* NASA. Marshall Space Flight Center Space Process. and Manufacturing 21 Oct. 1969 p 271-296 (See N71-11701 02-15)
(Contract NAS8-21402)
Avail: NTIS CSCL 13H

The formation of spheres in the zero-g enivornment of an orbitting spacecraft has the potential for enhancing the surface finish, hardness, sphericity and microstructural properties. Casting of composites has the potential for better fiber alignment and a more homogeneous structure which could lead to improved strength or unique physical properties. Described is a program conducted to assist the Manufacturing Engineering Laboratory of NASA/MSFC in the identification and selection of materials and methods for the spherical forming and composite casting experiments of the AAP Workshop. Author

N71-11720*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
NEW DEVELOPMENT IN SPACE MANUFACTURING
Hans F. Wuenscher *In its* Space Process. and Manufacturing 21 Oct. 1969 p 337-345 (See N71-11701 02-15)
Avail: NTIS CSCL 13H

The progress in space manufacturing development is reviewed. The possibilities of processes in zero and low g environment have been considered in industry, at universities and research institutes, and government agencies. Areas of interest stimulated conceptual studies and evaluation of economical aspects. In-depth assessment of feasibility is underway. The tabulation of unique space processes is brought up to date. New processes which have emerged are discussed. The present coverage by research and technology development toward space experiments is assessed, and recommendations for future development areas are given. Author

N71-11722*# General Dynamics Corp., San Diego, Calif.
COMPOSITE CASTING SUPERIOR STRUCTURAL MATERIALS THROUGH THE COMBINED APPLICATION OF UNIQUE ZERO g EFFECTS
W. H. Steurer *In* NASA. Marshall Space Flight Center Space Process. and Manufacturing 21 Oct. 1969 p 351-374 refs (See N71-11701 02-15)
Avail: NTIS CSCL 13H

Composite casting is of particular interest for the demonstration of space manufacturing capabilities in early experiments, since it (1) permits the application of basic zero-g processing concepts in a variety of effective combinations; (2) has a high assurance of experiment success. The effectiveness of various modifications and proposed specific experiments is assessed. The basic process, which employs primarily the zero-g phenomenon of mixture stability, comprises two methods: mold casting and free casting. The attainable end-product properties are determined by proper selection of matrix and reinforcement materials and by optimization of reinforcement shape, size and packing. Author

N71-11729*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THEORETICAL CONSIDERATIONS FOR LIQUID PHASE

SINTERING AND SOLIDIFICATION IN THE SPACE ENVIRONMENT

Richard Fabiniak (Cornell Aeron. Labs.), Thaddeus Fabiniak (Cornell Aeron. Labs.), Eugene McKannan, and Robert Abbott (State Univ. of N.Y., Buffalo) *In its* Space Process. and Manufacturing 21 Oct. 1969 p 448–468 refs (See N71-11701 02-15)
Avail: NTIS CSCL 13H

Many types of materials processing experiments planned for operation in the space environment involve crystal growth, metals joining, solidification or sintering. Complete characterization of the liquid-solid interface is essential for analysis of these experiments. The necessary interface condition of wetting is affected by both zero gravity and the composition of the environment. Sintering and joining processes involve two steps: (1) first a solid-solid phase; and (2) then a liquid-solid phase. Analysis of these processes shows that the first step is dependent on diffusion coefficients, vacancy concentrations in the bulk, surface energy and contact geometry, in addition to time and temperature. The second step is dependent on surface adsorption controlled by crystal faceting, grain boundary grooving, and thermal etching. Author

N71-11755 Bureau of Reclamation, Denver, Colo. Office of Engineering Reference.

DETERMINING THE CRITICAL SPEEDS OF HYDRAULIC UNIT SHAFTS [K OPREDELENIYU KRITICHESKIKH SKOROSTEI VALOV GIDROAGREGATOV]

L. L. Smelkov Mar. 1967 15 p refs Transl. into ENGLISH from Energomashinostroenie (USSR), v. 12, no. 1, 1966 p 21–22 *Its* Trans. No. 714
(PB-193634T) Avail: NTIS CSCL 10A

Effect of quasi-elastic forces of electromechanical origin on the primary critical speed of a shaft in calculating natural frequencies of torsional and transverse vibrations is shown. Solving the differential equations shows that electromechanical vibration frequency is from 0.5–2.5 cps, indicating that calculation of these values is obligatory to construct a full frequency spectrum. For transverse vibrations, a 1-sided electromagnetic pull between the rotor and stator and forces of inertia on the deflection of the shaft must be considered. It is concluded that calculating the electromagnetic field for torsional vibrations gives a smaller value for natural vibration frequency; and for transverse vibrations leads to a lowering of the primary critical speed. Sample calculations for a specific shaft are given. USGRDR

N71-11780# Bureau of Reclamation, Denver, Colo. Office of Engineering Reference.

DESIGNING HYDRAULIC TURBINE PARTS FOR STRENGTH

A. Ya. Aronson et al Aug. 1967 77 p refs Transl. into ENGLISH of the book "Raschet na Prochnost Detalei Gidroturbin" Moscow, Mashinostroenie, 1965 p 303–328 *Its* Trans. No. 687
(PB-193619T) Avail: NTIS CSCL 10A

A method of calculating stress conditions in metal spiral cases based on experimental investigations and study of shell structures for different turbine components is discussed. The method uses the principle of superposition of stress conditions of the: (1) joint of spiral case with speed ring, (2) region somewhat removed from the speed ring, (3) joint between steel sheets of different thicknesses, (4) transition zone from free shell to concrete embedment, and (5) end of the ribbing. Meridional forces are calculated from the membrane theory of torus-shaped shells. For moment and horizontal forces where the spiral attaches to the speed ring, the latter can be considered as a rigid torus-shaped shell or, for welded spiral cases, an imaginary conical shell can be substituted and equations for deformation of conical shells used. Experiments show that stresses are distributed very unevenly in each section, the greatest being where the spiral is joined to the speed ring bands. Where the lower part is embedded in concrete, stress inequality appears only in the upper band. USGRDR

N71-12002# Toronto Univ. (Ontario). Inst. for Aerospace Studies.

BONDED JOINTS: A REVIEW FOR ENGINEERS

V. Niranjan Sep. 1970 163 p refs Sponsored in part by the Natl. Res. Council, Ottawa
(UTIAS-28) Avail: Issuing Activity

The characteristics, production techniques, and stress analysis of bonded joints are discussed. Subjects presented are: (1) surface preparation, (2) selection of adhesives, (3) machining, (4) destructive and nondestructive testing, and (5) various types of bonded joints and structures. Author

N71-12026*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

TRANSIENT PERFORMANCE OF A TURBOALTERNATOR GAS-BEARING SYSTEM

James C. Wood, Joseph S. Curreri, and Armen S. Asadourian Washington Nov. 1970 24 p refs
(NASA-TN-D-6096; E-5820) Avail: NTIS CSCL 13I

The results of experimental operation of a gas-bearing turboalternator under various transient tests are presented in this report. The tests performed were rapid startup, change in operational mode of the thrust bearing, and stepping of the electrical load with two types of shaft speed control. The tests are representative of the condition that may be found in an actual space-power system. During the startup tests, the turboalternator journal bearing clearance exceeded the design limits but operated stably. The excessive clearance was caused by insufficient control of the collant through the bearing mount ring. The thrust bearing experienced large clearance changes during the alternator stepload transients. This was due to the method of speed control. The transient from hydrostatic to hydrodynamic operation on the thrust bearing took place smoothly. Author

N71-12036*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

GAS-FILM SEAL, TYPE A, APPENDIX A

L. P. Ludwig *In* Pratt and Whitney Aircraft Develop. of Mainshaft Seals for Advan. Air Breathing Propulsion Systems, Phase 2 23 Jun. 1970 p 65–76 refs (See N71-12035 02-28)
Avail: NTIS CSCL 11A

A face seal with self-acting geometry was designed for operation in gas turbine engines. Because of the noncontacting feature the seal has high speed and long life potential. Extensive use was made of molybdenum alloy in the design in order to minimize thermal gradients which cause detrimental seal deformation; in particular the seat, carbon retainer ring, carbon carrier and secondary seal were made from the molybdenum alloy. The seat was structurally isolated from the shaft by a radial spacer in order to mitigate the deformation effects caused by shaft thermal displacement. Further, the seat was clamped through a bellows which provided a predetermined amount of axial clamping and mitigated clamping distortions. Seat axial thermal gradients which induce undesirable deformations were minimized by thermal shielding and oil cooling. Further oil cooling the nosepiece assembly helped reduce the carbon temperature to a level at which oxidation was not a problem. Author

N71-12037*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

OIL-FILM SEAL, TYPE B, APPENDIX B

L. P. Ludwig *In* Pratt and Whitney Aircraft Develop. of Mainshaft Seals for Advan. Air Breathing Propulsion Systems, Phase 2 23 Jun. 1970 p 77–80 (See N71-12035 02-28)
Avail: NTIS CSCL 11A

The design goal was to minimize: (1) thermal gradients; (2) nosepiece (and carrier) mass; and (3) distortion at the seal dam. To obtain this goal, thermal distortion studies were made of all the seal parts and materials selection was based on distortion consideration as well as strength. The seal was designed to fit existing mainshaft seal rigs and consist of a resiliently clamped seat which is thermally isolated by three heat shields. Cooling holes are located near the hot gas side, and effects of shaft expansion are minimized by piloting the seal under the seat centroid. Seal cooling oil is directed to the seal interface from which it is expelled by centrifugal force and by the pumping action of the spiral grooves. This spiral groove and centrifugal force pumping action is sufficient to preclude a static oil pressure increase at the orifice exit. Lubrication film thickness over the spiral groove land areas determines the film thickness at the gas sealing dam. Author

N71-12038*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ANALYSIS OF SELF-ACTING GEOMETRY (RAYLEIGH STEP LIFT PAD) FOR GAS FILM SEAL, APPENDIX C

J. Zuk *In* Pratt and Whitney Aircraft Develop. of Mainshaft Seals for Advan. Air Breathing Propulsion Systems, Phase 2 23 Jun. 1970 p 81 – 95 refs (See N71-12035 02-28)
Avail: NTIS CSCL 11A

A parametric study was made on a face seal with a self-acting lift geometry. The analysis yielded the following results: (1) the characteristic steep gradient of lift force against gap height of the self-acting geometry was responsible for maintaining the small sealing gap height necessary for low leakage. Thus, the self-acting geometry provides a high gas film stiffness, which is necessary if the nosepiece is to track dynamically the face runout of the seal seat; (2) the gradient of self-acting lift force against film thickness was affected by the recess pad depth; the shallower recesses produced a steeper gradient; (3) for faces with angular deformation the self-acting lift force was less than that for parallel faces. Calculations for practical values of angular deformation indicated that the self-acting geometry produces a useful load; and (4) the self-acting pad geometry selected was a compromise between wear and load capacity considerations; that is, the recess depth selected was deeper than the optimum, and the recess length-to-land length ratio was smaller than the optimum. Author

N71-12039*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SEALING DAM DESIGN ANALYSIS, APPENDIX D

J. Zuk *In* Pratt and Whitney Aircraft Develop. of Mainshaft Seals for Advan. Air Breathing Propulsion Systems, Phase 2 23 Jun. 1970 p 97 – 110 refs (See N71-12035 02-28)
Avail: NTIS CSCL 11A

The results that are found were obtained by using computer programs. The design of the gas film seal required finding the smallest film thickness so the leakage is a minimum but yet a large enough film thickness such that both the power dissipation and subsequent shear heating is tolerable and potential seal face deformations can be accommodated. A rough calculation showed that the gap must be at least 0.1 mil for parallel surfaces. A larger gap than a 0.1 mil is necessary to accommodate deformation of the sealing faces. The effect of the sealing dam radial width (deltaR) on force balance suggested that radial widths of 20 mil, 50 mil, 80 mil and 100 mil be investigated in detail. Leakage flow rates of less than 25 SCFM were desired for all three design points. Author

N71-12089*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

ULTRASONIC TORQUE WRENCH

E. J. Minter 20 Mar. 1970 36 p
(NASA-TM-X-53995) Avail: NTIS CSCL 13I

Manual and semiautomatic ultrasonic torque wrenches for tightening flared tubing connections for sizes ranging from 0.318 to 2.54 cm diameter were designed, fabricated, and tested. During the torquing operation, ultrasonic energy is applied for a predetermined time to the coupling nut of the flared tube connection by the wrench head. The vibrational movement of the coupling nut results in reduced friction between the mating threads, permitting further tightening without the application of additional torque. In aluminum, ultrasonic activation of the wrench head during the application of torque provided an average of 0.25 rad additional rotation of the coupling nut without an increase in measured torque, increased the tensile strains in the coupling nuts, produced higher sealing stresses on the tube flares, and required increased breakaway torque to loosen the assemblies. However, the test showed that the wrench is too bulky and unwieldy to be of practical use. Author

N71-12112# Battelle Memorial Inst., Columbus, Ohio. Defense Metals Information Center.

PULSED-CURRENT ARC WELDING PROCESSES

J. J. Vagi, H. W. Mishler, and M. D. Randall Sep. 1970 29 p refs
(Contract F33615-69-C-1343)
(AD-712364; DMIC-MEMO-250) Avail: NTIS CSCL 13/8

Pulsed-current is used primarily with the gas tungsten-arc and gas metal-arc welding processes and, to a limited degree, with plasma-arc welding. The pulsed-current arc welding processes employ two levels of welding current instead of the single level that is used conventionally. Welding current is, in effect, switched between a high and a low level to produce a pulsating current or welding arc. Pulsed-current processes offer important advantages, including, among others, improved control of welding heat input rates, reduced distortion of the parts during welding, improved weld quality, and improved control of weld metal deposition in all welding positions. Pulsed-current gas tungsten-arc (PC-GTA) and pulsed-current gas metal-arc (PC-GMA) welding processes have been used for joining a variety of materials, including some that are often considered difficult-to-weld materials. The memorandum reviews the available literature that has been published on pulsed-current arc welding processes. In addition, information was obtained from numerous representatives of pulsed-current equipment manufacturers and users. Author (TAB)

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N71-11146# Wayne State Univ., Detroit, Mich.

A STUDY OF ENERGY TRANSFER PROCESSES IN MOLECULAR LASERS Technical Report, 26 Apr. – 31 Jul. 1970

Alexander J. Glass 31 Jul. 1970 6 p refs
(Contract DAHC04-70-C-0022; ARPA Order 675)
(AD-711614; TR-2) Avail: NTIS CSCL 20/5

A very brief summary is presented on the following research: Close coupling codes for the calculation of cross sections of interest to the molecular lasers N2, N2O, CO2, and CO; Extension of an existing computer program for the vibrational population distribution of a binary mixture of gases to include excitation and de-excitation processes specific to laser mixtures; Application of the spectroscopic observation of side light and small signal gain measurements to the determination of vibrational and rotational population distributions in the molecular laser systems under study (initially CO2 and CO); and Preliminary computer modeling of the laser system, including the effects of spatial variation of electron density and temperature and gas temperature. Author (TAB)

N71-11395# Oregon Graduate Center for Study and Research, Portland.

MULTIWAVELENGTH LASER PROPAGATION STUDY, 3 Quarterly Report, 16 Jun. – 15 Sep. 1970

J. Richard Kerr Oct. 1970 13 p refs
(Contract N00014-68-A-0461-0001; ARPA Order 306)
(AD-712097; Rept-1154-9; QR-1) Avail: NTIS CSCL 20/6

The report reviews activities in a comprehensive study of multiwavelength laser scintillations due to atmospheric turbulence. A large quantity of experimental data is being collected by means of repeated standard runs which include the determination of all pertinent properties of multiwavelength amplitude scintillations and turbulent structure. During the high turbulence conditions of the summer months, the spectrum of turbulence was found to agree with the 5/3 law with the existence of a well-defined inner scale. Also, scintillations have been strong at the 10.6 micron wavelength, where the transverse amplitude correlation length has been observed to be smaller than that for weaker turbulence. This improves the performance of aperture-averaging receivers at this important wavelength. The intermittency or spiking of turbulent temperature fluctuations was found to be a manifestation of the near log normality of the distribution of the absolute value of those fluctuations. The ramifications of this result are discussed. Author (TAB)

N71-11420# Southwestern Radiological Health Lab., Las Vegas, Nev.

LASER FUNDAMENTALS AND EXPERIMENTS

W. F. Van Pelt, H. F. Stewart, R. W. Peterson, A. M. Roberts, and J. K. Worst May 1970 24 p refs
(PB-193565; BRH/SWRHL-70-1) Avail: NTIS CSCL 20E

The manual was prepared in response to the increasing use of lasers in high schools and colleges. It is directed primarily toward the high school instructor who may use the text for a short course in laser fundamentals. The definition of the laser, laser operation, properties of laser light, biological effects of laser light, laser applications, safety in classroom laser use, and experiment section (equipment necessary for experiments) are included. The manual is written in a manner to give an intuitive understanding of the device and its inherent properties. The instructor is expected to be conversant with certain of the classical elementary theories of light. Author (USGRDR)

N71-11564# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Optics Div.

LASER GONIOMETRY ON SATELLITES

Claude Veret 1970 18 p refs Submitted for publication
(ONERA-TP-845) Avail: NTIS

In view of complementing the laser rangefinding to determine the position of a satellite from a single station, an apparatus was developed to obtain the angular coordinates. A 30-joule laser, carried on a tracking platform, illuminates the satellite carrying retroreflectors, and the echos are photographed through a Schmidt telescope installed on an equatorial mounting. The various pieces of equipment, the constraints of the installation as a whole, and the mode of operation, are described, and some of the obtained results given. The angular accuracy reached is 0.5 second of arc, i.e. 4 m at 1500 km. Author (ESRO)

N71-11567# Army Foreign Science and Technology Center, Washington, D.C.

INFLUENCE OF TRANSVERSE MAGNETIC FIELD ON EMISSION POWER AND POLARIZATION OF HELIUM-NEON LASER ON WAVELENGTH LAMBDA = 3.39 MU

V. M. Kulybin et al 1 Sep. 1970 11 p refs Transl. into ENGLISH from Izv. Vysshikh Vcheb. Zavedenii, Fiz. (Tomsk), v. 11, no. 10, 1968 p 130-134
(AD-712104; FSTC-HT-23-414-70) Avail: NTIS CSCL 20/5

The dependence of emission power and polarization of the helium-neon laser on transverse magnetic field and with change in resonator quality is investigated. The possibility of emission with circular polarization in a laser with Brewster windows has been established. Author (TAB)

N71-11577# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

SEARCH FOR AN OPTIMAL SOLUTION TO A SAMPLED AND QUANTIFIED DATA AUTOMATIC TRACKING PROBLEM [RECHERCHE D'UNE SOLUTION OPTIMALE A UN PROBLEME DE POURSUITE AUTOMATIQUE A DONNEES ECHANTILLONEES ET QUANTIFIEES]

Georges Seguin (Ph.D. Thesis—Paris Univ.) 1969 105 p refs In FRENCH; ENGLISH summary
(ONERA-NT-146) Avail: NTIS

The automatic tracking of missiles by laser beams is discussed. The problem presents two main characteristics: the information on the position of the tracked vehicle is only accessible at discrete times, rather widely spaced, and it is quantified by being known to be in one of only five zones. Several solutions are sought for this problem, in view of determining the optimal configuration of the tracking system: (a) a solution with a simple control law, the system parameters being optimized, (b) solutions with a continuous or discrete control law, derived from the maximum (Pontryagin) principle, with auto-adaptation of the system parameters, as a function of the dynamic law of the tracked missile. Author (ESRO)

N71-11580# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

STRUCTURAL EFFECTS AND SURFACE EROSION IN METALS IRRADIATED BY 10 TO THE MINUS 8th POWER SECOND LIGHT PULSES FROM A LASER

A. I. Akimov et al 31 Jul. 1970 17 p refs Transl. into ENGLISH from Fiz. Khim. Obrab. Mater. (USSR), no. 2, 1969 p 11-18
(AD-712232; FTD-HT-23-368-70) Avail: NTIS CSCL 20/5

The surfaces of twenty metals and several steels were studied after the action of a modulated light pulse. On the surface of the specimens spots appeared with a rough surface which, as the profilograms showed, had a rippled structure. The height of projections and depth of depressions grow with a decrease in the melting point of the metal. The effects of the increase in density of crystal-lattice defects are observed to be considerably less in absolute magnitude than when under the effect of unmodulated pulse of the same energy. Apparently, structural effects in metal are caused from the heating of the metal by expanding plasma, and the wave-shaped profile of the surface appears when it melts and comes under the effect of a shock wave. Author (TAB)

N71-11581# Army Foreign Science and Technology Center, Washington, D.C.

INFLUENCE OF LASER RADIATION ON METALS [VLIYANIYE IZLUCHENIYA OKG NA METALLY]

L. M. Shestopalov et al 22 Apr. 1970 19 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Metally (Moscow), No. 2, 1969 p 96-104
(AD-712341; FSTC-HT-23-275-70) Avail: NTIS CSCL 20/5

The work presents a comparative study of the behavior of a large number of metals under the influence of light fluxes with densities up to 100000 w/cm2. The structure and properties of the irradiated surface are analyzed. The experimental procedures are described. TAB

N71-11582# Northrop Corporate Labs., Hawthorne, Calif. Electromagnetics Lab.

CO2 LASER PULSING TECHNIQUES Annual Report, Dec. 1969-Dec. 1970

M. L. Bhaumik and M. M. Mann Sep. 1970 16 p refs
(Contract N00014-70-C-0185; ARPA Order 306)
(AD-712117; NCL-70-64R; AR-1) Avail: NTIS CSCL 20/5

In a study of CO2 laser pulsing techniques stable mode locking of a CO2 laser was achieved with the use of a resonated internal electro-optic phase modulator driven at frequencies near the axial mode interval. Pulses of 25 nanosecond duration and 147 nanosecond period were observed. Pulse trains at twice the fundamental mode frequency were also obtained. Stable locking was achieved with an r.f. input power to the modulator of less than 1 milliwatt. Locking could be induced when the modulation frequency was within plus or minus 130 kHz of the fundamental axial mode frequency. TAB

N71-11598# Ohio State Univ., Columbus. Electroscience Lab.
POTENTIAL LASER ACTION IN A FLAME Final Report, 23 Dec. 1968 – 30 Apr. 1970
Said Koozekanani Aug. 1970 20 p refs
(Contract DAHC04-69-C-0033; ARPA Order 675)
(AD-711581; ESL-2745-3; AROD-7765-1-P) Avail: NTIS CSCL 20/5

A continuous sheet of flame, i.e., a region where chemical reaction and excitation takes place was developed. This region is two inches wide and is several feet in length and operates at very low pressures where collisional de-excitation decreases greatly. The by-products of the flame are then expanded and pumped out. The flame itself is a few centimeters in thickness and the pressure across it remains constant. However the pressure decreases as one approaches the vacuum pump input region. The potentialities of chemical excitation in this form has not yet been fully investigated. However, a region in the form of a long strip where intense chemical reactions take place at very low pressures, i.e., about 1/200th of atmospheric pressure has been confined. Out of the heat of combustion released, it is highly probable that some of the energy will be exciting some of the vibrational levels of the by-products. Author (TAB)

N71-11599# Compagnie Francaise Thomson Houston-Hotchkiss Brandt, Paris.
TRANSLATIONAL DEVICE CORRECTION AND CONTROL USING LASER INTERFEROMETRY [DISPOSITIF DE TRANSLATION CORRIGE ET CONTROLE PAR INTERFEROMETRIE LASER]
1970 11 p In FRENCH Presented at the Intern. Conf. on Advan. Microelectron., Paris, 6 – 10 Apr. 1970 Sponsored by DGRST
Avail: NTIS

Two laser interferometers are used to detect the swaying of a plate during a translation. Their measurements yield error signals dependent on the amplitude of the parasitic movement of the plate. Error signals are applied to piezoelectric ceramics that will take up the swaying and produce a straight translation within + or − 0.03 microns. Laser interferometers can also be used to measure the length of the translation with an accuracy of 0.04 microns. ESRO

N71-11600# Compagnie Francaise Thomson Houston-Hotchkiss Brandt, Paris.
MICRO-DISPLACEMENT MEASUREMENT USING LASER INTERFEROMETRY [MESURE DE MICRO DEPLACEMENTS PAR INTERFEROMETRIE LASER]
R. Marcy 16 Mar. 1970 20 p In FRENCH
(Rept-70-75/4) Avail: NTIS

A simple device based on laser interferometry is described which measures absolute and differential angular displacement with a resolution of 0.08 microns. ESRO

N71-11612# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RELATION BETWEEN THE ANGULAR DIVERGENCE, SPECTRAL WIDTH, AND KINETIC BEHAVIOR OF A LASER
A. M. Ratner 6 Aug. 1970 39 p refs Transl. into ENGLISH from Resp. Seminara. Tr. Kvantovaya Elektron. (Kiev), no. 3, 1969 p 230 – 252
(AD-712233; FTD-MT-24-142-70) Avail: NTIS CSCL 20/5

Theoretical study of the relation between the angular divergence and spectral characteristics of the light beam of a laser operating in various pulsed modes. Discussed specifically are: the dependence of the spectral composition of a laser beam on its angular divergence in the case of nondegenerate modes; the dependence of the spectral width of a laser beam on its angular divergence in the case of strongly degenerate modes; the dependence of the kinetic behavior of a laser on the angular divergence of its light beam, and the dependence of the spectral width of a laser beam on the kinetic behavior of the laser. It is concluded, that, regardless of its angular divergence, the spectral width of a laser beam tends to become smaller when the dependences of all the generated modes are about equal. Author (TAB)

N71-11668*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FIVE-MICRON LASER RADIATION FROM A CARBON MONOXIDE GASDYNAMIC EXPANSION
Robert L. McKenzie Oct. 1970 28 p refs
(NASA-TM-X-62006) Avail: NTIS CSCL 20E

Laser power at 5 microns was obtained from the gasdynamic expansion of admixtures of carbon monoxide. Mixtures of CO and N2, diluted in some cases with argon, were heated by reflected shock waves and expanded through a supersonic nozzle containing an optically resonant cavity. The resulting laser radiation, at wavelengths between 4.78 and 5.4 microns, originated from a multitude of partially inverted CO vibrational states. The spectral and laser power characteristics were consistent with radiative gain predictions from numerical solutions of the master rate equations for the vibrational relaxation of anharmonic oscillators. The experimental ratio of multimode laser power, normalized by the total enthalpy flow rate or power supplied to the reservoir, was equal to or greater than that obtained from similar CO2 gasdynamic lasers. Author

N71-12049*# Translation Consultants, Ltd., Arlington, Va.
SOME CHARACTERISTICS OF THE LASER BEAM EROSION OF MATERIALS [NEKOTORYYE OSOBENNOSTI EROZII MATERIALOV PRI VOZDEYSTVII IZLUCHENIYA OKG]
O. I. Putrenko et al Washington NASA Dec. 1970 10 p refs Transl. into ENGLISH from Zh. Prikl. Spektroskopii, Akad. Nauk Belorussk. SSR (Minsk), v. 11, no. 4, Oct. 1969 p 617 – 622
(Contract NASw-2038)
(NASA-TT-F-13338) Avail: NTIS CSCL 20E

Space distribution of condensed matter ejected from metals subjected to laser radiation erosion was investigated to improve spectral analysis sources with simultaneous use of electrical discharge. Laser pulse energy was 7 j and the light was coned by means of a lens. Angular distribution of matter ejected was measured for Cu alloys, Zn, Fe, Fe-Si, Pb, Sn, Al, Mg, and W condensed on a glass plate situated perpendicularly to the laser beam. Maximum density of the condensed material and the angular position of this maximum were plotted as a function of the melting point of the material. Chemical composition of the sample corresponds to that of the ejected material. An arrangement of electrodes for spectral analysis carried out during simultaneous laser function and discharge was proposed. Author

N71-12118# Defence Research Board, Ottawa (Ontario). Defence Scientific Information Service.
SOME APPLICATIONS OF LASER IN BALLISTIC RESEARCH
K. Vollrath (Inst. Franco-Allemand de Recherches) Nov. 1970 40 p refs Transl. into ENGLISH from French Report T31/66 Sponsored in part by the Min. Federal de la Defense
(T-126-G(2); T31/66) Avail: NTIS

The application of various lasers to ballistic research is presented. The lasers are used in an aeroballistic tunnel for reflected light photography, cinematography, holography and velocity measurement by means of interferometry. The production of plasmas and shock waves and the initiation of explosives by means of focused laser beams is discussed. Author

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N71-11132# Naval Research Lab., Washington, D.C. Strength of Metals Branch.

SUBCRITICAL CRACK GROWTH IN SEVERAL TITANIUM ALLOYS Final Report

T. W. Crooker, R. W. Judy, Jr., and L. A. Cooley Sep. 1970 22 p refs
(AD-712056; NRL-MR-2160) Avail:NTIS CSCL 11/6

Studies of low-cycle fatigue crack propagation in air and in salt water environments and salt water stress-corrosion cracking (SCC) were conducted on several intermediate-to-high strength, very low interstitial oxygen, titanium alloy plate materials. The alloys studied included one sample each of Ti-7Al-2Cb-1Ta and Ti-7Al-2.5Mo, and two samples each of Ti-6Al-4Vand Ti-6Al-6V-2Sn. The yield strengths of these alloys ranged from 110 to 150 ksi (77.3 to 105.5 kgf/sq mm) and included both as-received and heat-treated conditions. Fatigue and SCCdata were obtained from single-edge-notched (SEN) cantilever specimens, and the results were analyzed in terms of crack tip stress-intensity parameters. Most of the alloys investigated exhibited low resistance to low-cycle fatigue crack propagation. The most favorable results were obtained from the Ti-6Al-4Valloys. However, several alloys were highly resistant to environmentally-accelerated crack growth in salt water. Several alloys also showed a correlation between fatigue crack growth behavior in salt water and the threshold stress-intensity for SCCto occur (Ksub Iscc). Examination of fatigue surfaces by electron fractography revealed that the predominant mode of separation was microvoid coalescence, regardless of environment. Author (TAB)

N71-11142# Boeing Co., Renton, Wash. Commercial Airplane Group.

OPTIMIZATION OF PROPERTIES IN TWO HIGH STRENGTH STAINLESS STEELS

Donald Webster Aug. 1970 24 p refs
(Contract N00014-66-C-0365; ARPA Order 878)
(AD-711608; D6-25427) Avail: NTIS CSCL 11/6

It was found possible to increase the strength and toughness of two high-strength stainless steels, AFC 77 and AFC 260, by austenitizing at higher-than-normal temperatures that are in the range where both austenite and delta ferrite are stable. The delta ferrite is then removed by isothermal transformation in the range 1800 to 2000F. This technique results in a greater solution of carbides and intermetallic particles and consequently in a greater amount of retained austenite than is possible at austenitizing temperatures below the delta-ferrite range. In addition, the technique permits optimum mechanical properties to be obtained over a wider compositional range. Author (TAB)

N71-11389# National Science Foundation, Washington, D.C.

PARAMETERS OF SELF-DIFFUSION OF Fe IN THE DELTA-REGION OF Fe AND IN Fe ALLOYS WITH SMALL ADDITIONS OF Al [O PARAMETRAKH SAMODIFFUZII ZHELEZA V OBLASTI DELTA-ZHELEZA I SPLAVOV ZHELEZA S MALOI PRIMESYU ALYUMINII]

S. D. Gertsriken et al 1970 11 p refs Transl. into ENGLISH from Sb. Nauchn. Rabot, Akad. Nauk Ukr. RSR, Inst. Metallofiz. (Kiev), no. 10, 1953 p 68-73
(TT-70-57043; DMDC-2655) Avail: NTIS CSCL 11F

The self-diffusion of Fe in the temperature range 1400-1480C was studied using Fe59 and Fe55 as a tracer. In addition to the study of pure iron, iron-aluminum alloys containing 27% Al and 39% Al were investigated by autoradiographic techniques. Some data were also obtained at temperatures between 1320 to 1400C. Author (USGRDR)

N71-11390# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.

HEAT AGING EVALUATION OF COMMON COATED COPPER CONDUCTORS

J. H. Burns, G. A. Busch, D. J. Larson, Jr., and T. B. McCune (Hudson Wire Co., Ossining, N.Y.) Nov. 1970 23 p Presented at 19th Intern. Wire and Cable Symp. Atlantic City, 2-4 Dec. 1970
(RM-488J) Avail: NTIS

This evaluation was to determine the effects of aging at normal elevated service temperatures on electrical conductivity and mechanical flexibility of commonly used coated conductors. The environment of testing was a circulating air atmosphere at selected temperatures of testing with the assumption that degradation of desired properties occurs in two ways: oxidation of the protective coating at exposed termination points, and diffusion or alloying of the coating metal with the base metal. During the investigation it became evident that tin coated conductors exhibited erratic behavior at all testing temperatures. The effects of heat aging of commonly used coatings with a particular emphasis on tin coated conductors are described. Author

N71-11426*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EVALUATION OF NiCrAl AND FeCrAlY CLADDINGS ON T D-NiCr: MACH 1 BURNER RIG TESTS AT 2100 F (1149 C)

M. A. Gedwill and S. J. Grisaffe Nov. 1970 13 p refs
(NASA-TM-X-52916; E-6021) Avail: NTIS CSCL 11F

Foils, of several oxidation resistant alloys approximately 5 mils thick, were diffusion bonded to TD-NiCr. The protection potential of these claddings for use on aircraft gas turbine components was examined by conducting Mach 1 burner rig tests at 2100 F for time periods up to 160 hours using 1 hour cycles. The NiCrAl cladding was protective for over 120 hours. All of the FeCrAlY alloys, however, began suffering from oxidation and loss of cladding after 20 to 40 hours of testing. Visual indications of interdiffusion were observed in TD-NiCr for both cladding systems. Author

N71-11429# Cranfield Institute of Technology (England). Dept. of Materials.

THE WELD HEAT-AFFECTED ZONE NOTCH-IMPACT PROPERTIES OF SEMI-KILLED C-Mn STEEL AND A FULLY KILLED ALUMINIUM GRAIN-REFINED C-Mn STEEL

E. Smith Apr. 1970 21 p refs
(MAT-1) Avail: NTIS

Structures representative of the visible weld heat-affected zone (HAZ) of a semikilled C-Mn steel and a fully killed and normalised aluminum grain-refined C-Mn steel were produced by means of a simulation technique. The Charpy 5 notch impact properties were assessed and related to microstructure. The only significant deterioration in impact properties occurred in the coarse grained HAZ of the aluminum grain - refined steel. The notch - impact properties of the subcritical weld HAZ were assessed by simulating specimen blanks with and without notches through thermal cycles reported to cause the greatest degree of subcritical embrittlement in these steels. The results show that no significant embrittlement occurred in either steel in the absence of notches. In the presence of a notch there was evidence of an increase in transition temperature of 10 to 35 C in the semikilled steel but no increase in the aluminum grain - refined steel. The slight increase for the semikilled steel was attributed to the presence of free nitrogen, which was absent in the aluminum grain - refined steel. Author

N71-11430*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

AUGER ELECTRON SPECTROSCOPY STUDY OF SURFACE SEGREGATION IN COPPER-ALUMINUM ALLOYS

John Ferrante and Donald H. Buckley Washington Nov 1970 16 p refs

(NASA-TN-D-6095; E-5846) Avail: NTIS CSCL 11F

Surface segregation of aluminum has been observed in copper-aluminum alloys by use of LEED and Auger electron spectroscopy studies. The alloys were solid solutions of aluminum in copper having compositions of 1, 5, and 10 atomic percent aluminum. All samples were single crystals oriented in the (111) direction. Surface concentrations five times that in the bulk were observed. LEED and characteristic loss data gave confirming evidence of surface composition changes. Surface concentration increased with temperature on heating to 700 C. Author

N71-11436# Virginia Univ., Charlottesville. Research Labs. for the Engineering Sciences.

OXIDE FORMATION IN EVAPORATED THIN FILMS OF TANTALUM

Kenneth R. Lawless and Frances M. Berting Aug. 1970 210 p refs

(Contract N00014-69-A-0060-0002)

(AD-711634; MS-3531-110-70U) Avail: NTIS CSCL 11/6

The oxidation of evaporated single crystal Ta films has been carried out in situ in the electron microscope. In order to provide greater assurance that the gas reacting with the Ta film was oxygen rather than nitrogen or carbon vapors residual in the electron microscope column, a vacuum system was designed and assembled to provide auxiliary pumping directly on the sample chamber; a liquid-nitrogen cooled plate was installed in the chamber above the sample to trap contamination; and an oxygen inlet was inserted at the level of the sample itself. Tantalum films of (001) orientation were prepared by evaporation in a separate high-vacuum station, using a 2 kW electron beam gun. Two progressions of oxidation were observed, one under the low oxygen pressure conditions and one under the higher oxygen pressure. The ordered domains producing the 2-fold cubic superlattice are thought to be an early stage of TaO(y), the orthorhombic platelets a later form with the same suboxide designation. Author (TAB)

N71-11442# National Aeronautical Establishment, Ottawa (Ontario).

RESIDUAL STRESS ANALYSIS IN PLASTICALLY DEFORMED METALS OF LOW STACKING FAULT ENERGY

W. Wallace, T. Terada, and M. Grzedzielski Jan. 1970 34 p refs

(NRC-11410; MS-129) Avail: NTIS

Two X-ray diffractometer techniques are used to measure the surface residual stresses and residual stress distributions in cold-rolled alpha-brass (30% Zn). Data obtained by the two-exposure method and the lattice parameter extrapolation method of Wagner et al. are compared with the residual stress distributions suggested by strain-gauge relaxation behaviour. Predominantly tensile surface stresses were measured for deformations up to 50% reduction in thickness and negligibly small stacking fault densities. The causes of various anomalous results are discussed. Author

N71-11444# Joint Publications Research Service, Washington, D.C.

SUBSTRUCTURAL HARDENING AND GAS EXTRUSION OF METALS

22 Oct. 1970 30 p refs Transl. into ENGLISH from Fiz. Khim. Obrab. Mater. (Moscow), no. 4, 1970 p 59 – 74 and 147 – 148

(JPRS-51624) Avail: NTIS

CONTENTS:

1. HIGH-STRENGTH STATE OF METALS RESULTING FROM SUBSTRUCTURAL HARDENING L. K. Gordiyenko p 1 – 24 refs (See N71-11445 02-17)

2. POSSIBILITY OF GAS EXTRUSION OF MATERIALS L. F. Vereshchagin et al p 25 – 28 refs (See N71-11446 02-15)

N71-11445# Joint Publications Research Service, Washington, D.C.

HIGH-STRENGTH STATE OF METALS RESULTING FROM SUBSTRUCTURAL HARDENING

L. K. Gordiyenko *In its* Substructural Hardening and Gas Extrusion of Metals 22 Oct. 1970 p 1 – 24 refs (See N71-11444 02-17)

Avail: NTIS

The physical principles of the high-strength state of metals combined with an increased level of thermal stability are discussed. Substructural hardening of metals and alloys by the thermomechanical treatment and multiple thermomechanical treatment methods along with analysis of the laws of evolution of substructure and properties under the thermoplastic effect in the precrystallization temperature range are reported. In addition, general laws governing the behavior of face-centered cubic and body-centered cubic metals and alloys hardened by the mechanisms of polygonization and cellular fragmention are investigated. E.M.C.

N71-11565# Cranfield Institute of Technology (England).

FATIGUE IN SOME ALUMINIUM ALLOYS WITH CONSTANT FORCE OR CONSTANT AMPLITUDE CONTROL AT 20 kHz

B. S. Hockenhull, C. N. Owston, R. G. Hacking Jun. 1970 22 p refs

(MAT-3) Avail: NTIS

An improved 20kHz fatigue apparatus was constructed. This equipment allows tests at up to 50% higher strain levels than those achieved with earlier apparatus and also has the facility of controlling amplitude, force, or power during tests. Preliminary evolution tests were made on the equipment and these are described. Author

N71-11566# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

IMPROVEMENTS IN THE MICROPROBE ANALYSIS OF DIFFUSION LAYERS: APPLICATION TO AN INCONEL 713 CHROMALUMINISED SAMPLE [PERFECTIONNEMENTS AUX METHODES D'ANALYSE PAR MICROSONDE DES COUCHES DE DIFFUSION. CAS DE L'INCONEL 713 CHROMALUMINISE]

Jacques Descamps and Gabriel Lenoir 1970 21 p refs In FRENCH and ENGLISH Submitted for publication

(ONERA-TP-836) Avail: NTIS

A simultaneous use of various microprobe analysis techniques is necessary for a thorough study of the complex diffusion layer occurring while coating heat resistant alloys by chromaluminization. It is pointed out that each technique provides different information and emphasis is laid on the special practical power of a scanning analysis method integrating concentration over a significant volume of material. Precise evaluation of geometrical increase in volume and estimation of chromium and aluminum feeding from the cement can be achieved with a connected method. A typical example is given of an Inconel 713 turbine blade protected by chromaluminization. Author (ESRO)

N71-11573*# Arkansas Univ., Little Rock. Dept. of Mechanical Engineering.

OXIDATION AND AGGLOMERATION RESISTANCE OF THIN GAGE DISPERSION STRENGTHENED ALLOYS Final Report

D. M. Scruggs Jun. 1970 44 p refs
(Grant NGR-04-001-029)
(NASA-CR-111807) Avail: NTIS CSCL 11F

Four potential candidate materials for thin sheet aircraft applications were tested in air at 760 and 8 torr in the temperature range 1200 to 2000 F (650 to 1093 C). All materials were dispersion strengthened with 2 volume percent thoria and were nickel base (TD Ni), 80 nickel and 20 chromium (TD NiCr); cobalt base, 20 nickel and 18 chromium (TD Co); and cobalt base, 20 nickel and 30 chromium (TD Co(+)). The exposed specimens were examined by optical microscopy, microhardness testing, electron microscopy, and thoria particle size analysis. Oxidation rate data were collected. Microscopy of the TD NiCr suggests that controversy over the composition of the oxide layer on nickel–chromium alloys may be traceable to the formation of a chromium sesquioxide layer saturated with nickel–chromium spinel that precipitates upon slow cooling from elevated temperatures. TD NiCr scales at 1600 F (870 C) and below while the cobalt alloys exhibit excellent scaling resistance. Author

N71-11574# Boeing Co., Renton, Wash. Commercial Airplane Group.

EFFECT OF PRESTRESSING ON THE STRESS-CORROSION RESISTANCE OF TWO HIGH-STRENGTH STEELS

Clive S. Carter May 1970 19 p refs
(Contract N00014-66-C-0365; ARPA Order 878)
(AD-711606; D6-25275) Avail: NTIS CSCL 11/6

Precracked, single-edge-notched specimens of 4340 steel (194-ksi yield strength) and 18% Ni maraging 300 steel were prestressed in laboratory air to various percentages (0 to 90%) of K sub Ic and then unloaded. The times to failure were subsequently determined in 3.5% aqueous NaCl solution as a function of initial stress intensity. Prestressing increased the threshold stress intensity K sub Iscc of the 4340 steel, but had only a slight effect on the K sub Iscc of the maraging steel. The times to failure of both steels at initial stress-intensity levels above K sub Iscc were unaffected by prestress. The prestressing effects are attributed to the presence of compressive stresses at the crack tip. Author (TAB)

N71-11575# MSA Research Corp., Evans City, Pa.

EFFECT OF HIGH-TEMPERATURE SODIUM ON THE MECHANICAL PROPERTIES OF CANDIDATE ALLOYS FOR THE LMFBR PROGRAM Final Report

L. H. Kirschler, R. H. Hiltz, and S. J. Rodgers May 1970 216 p refs
(Contract AT(11-1)-765)
(MSAR-70-76) Avail: NTIS

High oxygen-sodium and carbon-sodium excursions of Type 304 and 316 stainless steels at 1200 and 1400 F were completed, followed by creep-rupture testing in high velocity clean sodium and tensile tests in air. Creep rupture properties of these steels in clean dynamic sodium were tested following long-term exposures in clean static sodium. Tensile tests in air were also conducted. Tensile tests and metallurgical studies were completed on 6 candidate ferritic steel alloys exposed to decarburizing static sodium environment. Vanadium alloys were metallographically examined after sodium exposure. The super-plastic alloy, IN-744, and U. S. Steel alloy 18–18–2, were exposed to three separate sodium environments, followed by tensile tests and metallographic studies. A linear variable differential transformer type of extensometer was developed and successfully tested in 1200 F sodium. Attempts were made to measure and evaluate the effects of oxygen on the surface tension of sodium. The first UNC carbon meter and UNC oxygen meters were field tested and calibrated. NSA

N71-11585# Norske Veritas, Oslo.

AN EVALUATION OF THE CHARPY IMPACT TEST

O. Harsem and H. Wintermark 1969 34 p refs Presented at the ASTM Ann. Symp. on Impact Testing of Metals, Atlantic City, 25 Jun. 1969 Sponsored in part by Roy. Norweg. Council for Sci. and Ind. Res., A/S Kvaerner Brug, and A/S Moss Vaerft and Dokk
Avail: NTIS

The suitability of the Charpy impact test as an acceptance test for high tensile, fine grain treated steel, intended for service temperatures down to −40 and −50 C, is investigated. For a series of structural steels, with yield point between 32 and 49 kgf/sq mm, then scattering test results from Charpy testing are studied. All the steel types are also subjected to the NRL drop-weight test, and the various test methods are compared. ESRO

N71-11586# British Steel Corp., London (England). Inter-Group Labs.

RAPID HEATING BY JET IMPINGEMENT METALLURGICAL IMPLICATIONS

T. D. Boxall and R. C. Willingham 1969 16 p refs
(DIS/1/69) Avail: NTIS

A metallurgical investigation into the jet impingement technique of rapidly heating steel billets for hot working is studied. Six different steels were examined for decarborization, scaling, and general surface quality, and the results were compared with similar steels heated in conventional reheating furnaces. The improved quality of billets heated by jet impingement is demonstrated. Author

N71-11587# New Mexico Inst. of Mining and Technology, Socorro.

FRACTURE PHENOMENA IN EXPLOSIVELY LOADED MAGNESIUM Technical Report, 1 Feb. 1967 – 1 Feb. 1970

Ching H. Ma and David W. Mitchell Sep. 1970 40 p refs
(Contract N00014-67-A-0267-0003)
(AD-712129; MT-70-1; TR-2) Avail: NTIS CSCL 11/6

Fracture phenomena in polycrystalline magnesium subject to explosive-loading have been investigated in the pressure range of approximately 60 K bars to 110 K bars. It was found that the types of fractures were influenced by shock strength as well as wave reflections on grain boundaries and specimen edges. The results were interpreted in terms of phenomenological observations and in the light of dislocation pile-up in the specimens in a highly dynamic stress field during shock-leading. Author (TAB)

N71-11592# Royal Aircraft Establishment, Farnborough (England).

THE GROWTH OF THIN NICKEL FILMS ON A (111) ALUMINIUM SURFACE

G. Dorey Nov. 1968 18 p refs
(RAE-TR-68266) Copyright. Avail: NTIS

Nickel films 35 A thick were deposited in UHV on to clean (111) aluminium surfaces at various temperatures between 70 C and 330 C, to determine over what temperature range a thin continuous layer of Ni or Ni rich phase could be obtained. At 70 C the Ni formed an epitaxial layer containing small epitaxial particles of AlNi. At 250 C a continuous layer of Al3Ni was produced with no preferred orientation. At 330 C an island structure was obtained with the islands elongated in the Al (110) directions: the islands were unstable at 330 C and tended to become spherical to minimise their surface area. Comparison with deposits on NaCl indicated that Ni atoms are more mobile on Al at about 300 C than they are on NaCl at the same temperature. Author

N71-11632# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

STRUCTURE AND PROPERTIES OF UNIDIRECTIONALLY SOLIDIFIED SUPERALLOYS [STRUCTURE ET PROPERTIES DES SUPERALLIAGES A CRISTALLISATION ORIENTEE]

Herve Bibring *In* AGARD Advanced Technol. for Production of Aerospace Eng. Sep. 1970 9 p refs In FRENCH; ENGLISH summary (See N71-11626 02-28)
Avail: NTIS

The principles of unidirectional solidification are first reviewed and the application of this process to superalloys peculiarly to the production of turbine blades and vanes is discussed. The outstanding modifications of the structure and the properties of the alloys cast by this method are outlined. Unidirectionally, solidified parts display elongated grains laying parallel to the solidification axis. In Ni or Co base superalloys, belonging to the FCC structure, these grains have a preferential cristallographic orientation along the cube edge <011>. No transverse grain boundaries are present. The micrographic structure and the chemical segregation are very similar to those observed in conventionally cast alloys. Among mechanical properties tested along the solidification axis, the ductility is improved at every temperatures and the time to rupture on creep, especially at moderate temperature, is enhanced. The results of tensile and creep tests performed normally to the growth direction are similar to characteristics of conventionnaly cast alloys. In addition, the absence of transverse grain boundaries favors the application of coating against hot corrosion. The unidirectional casting opens a promising way for using high strength superalloys with a low Cr content which were too brittle and more difficult to protect against corrosion when conventionally cast. Author

N71-11662*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ALLOY SOFTENING IN GROUP VIA METALS ALLOYED WITH RHENIUM
Joseph R. Stephens and Walter R. Witzke Washington Nov. 1970 27 p refs
(NASA-TN-0-7000; E-5680) Avail: NTIS CSCL 11F

An investigation was conducted to determine the effect of temperature and composition on alloy softening in group VIA metals Cr, Mo, and W alloyed with Re. Results showed that alloy softening was similar in all three alloy systems occurring at homologous temperatures less than 0.16 and at Re concentrations less than 16 atom percent. Rhenium content required to produce a hardness minimum diminished rapidly in all three systems with increasing test temperature. The similarities in hardness behavior in these three alloy systems suggest a common softening mechanism which may arise from lowering the Peierls stress. Author

N71-11669*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SHORT-TIME STRESS RUPTURE OF PRESTRESSED TITANIUM ALLOYS UNDER RAPID HEATING CONDITIONS
Carl R. Johnson and John D. Grimsley Washington Nov. 1970 19 p refs
(NASA-TN-D-6052; G-989) Avail: NTIS CSCL 11F

Short-time creep-rupture life properties are discussed of four preloaded titanium alloys under rapid heating conditions. The specimens were resistantly heated, and some comparisons were made with radiantly heated specimens. Author

N71-11670# American Cyanamid Co., Stamford, Conn. Central Research Div. Labs.
PASSIVATION OF METAL AIRCRAFT SURFACES Final Report, 1 Jan. – 30 Jun. 1970
Francis C. Rauch and Fred W. Luciw Jul. 1970 29 p refs
(Contract N00019-70-C-0228)
(AD-711950; Avail: NTIS CSCL 11/3

An effort was directed toward the screening of a variety of appropriately modified chelating agents as corrosion resistant and adhesion promoting treatments for mild steel, stainless steel and titanium alloys. The program was essentially an extension of earlier work in which the general validity of the concept had been demonstrated for aluminum substrates. Several types of chelating agents were found to be effective in varying degrees as paint primers on E4130 annealed aircraft steel and 321 stainless steel. The formulation previously found to be the most effective for aluminum proved to be an effective treatment for the ferrous substrates as well. Some indications were obtained that it was superior to state-of-the-art phosphatizing treatments and wash primer as a paint primer for steel. Under application conditions similar to those used for aluminum and steel, titanium was found to be resistant to all of the treatments assayed. A technique involving abrasion of the titanium submerged in a de-oxygenated solution of the chelating agent was found to give a substantial increase in the paint retaining properties of the titanium. Author (TAB)

N71-11671# Avco Lycoming Div., Stratford, Conn.
FEASIBILITY STUDY OF COLUMBIUM ALLOY CASTINGS Quarterly Progress Report, 1 Feb. – 30 Apr. 1970
R. J. Beauregard and J. J. Walters Aug. 1970 46 p refs
(Contract DAAGH6-69-C-0163)
(AD-711930; Rept-2195.8.7; AMMRC-CR-70-5/3; QPR-3) Avail: NTIS CSCL 11/6

During the quarter, two pours of alloy B-66 were made into fluidity molds having two tungsten layers. One pour was made into an unheated mold, and one pour was made into a mold preheated to 1160 F. Preheating of the mold resulted in greatly improved fluidity with no serious contamination. Based on the eight B-66 fluidity castings produced so far in this program, two-layer molds preheated to 1400 F were selected as the optimum for the production of Phase 2 test specimens and vanes. One additional pour of alloy WC-3015 was made in a one-tungsten-layer fluidity mold preheated to 1300 F. No improvement in fluidity was seen compared with previous preheated two-layer molds. Based on the eight WC-3015 fluidity castings made in this program, two-layer molds preheated to 1400 F were selected as the optimum for Phase 2. Author (TAB)

N71-11689*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SURVEY OF MATERIALS FOR THERMIONIC CONVERTERS
Arthur L. Smith Washington Nov. 1970 54 p refs
(NASA-TM-X-2130; E-5789) Avail: NTIS CSCL 11F

The survey is intended for the use of people unfamiliar with the field. The effect of material selection and characteristics on the electrode properties is emphasized. The following areas are explored: (1) materials requirements, (2) identification of materials most likely to meet these requirements, (3) relevant physical and mechanical properties of these materials, and (4) proposals for modifying these materials for improved systems performances. Author

N71-11696# Naval Research Lab., Washington, D.C.
STRESS-CORROSION CRACKING: A PERSPECTIVE REVIEW OF THE PROBLEM
B. F. Brown 16 Jun. 1970 27 p refs
(ARPA Order 878)
(AD-711569; NRL-7130) Avail: NTIS CSCL 11/6

Definitions are given of a number of terms relating to crack propagation caused by the conjoint action of stress and corrosion and related phenomena. This is followed by a brief historical review during the course of which it becomes evident that stress-corrosion cracking, far from being restricted to a few alloys, is a general phenomenon observed in most families of alloys if the composition, heat treatment, and environment are favorable. The role of fracture mechanics in conducting and interpreting stress-corrosion cracking tests is discussed, and the several classes of mechanisms which have been postulated to account for stress-corrosion cracking are enumerated. The most serious deficiency in stress-corrosion technology is the inability to predict those combinations of alloys and environments which will give rise to stress-corrosion cracking. Author (TAB)

N71-11697# Addis Translations International, Woodside, Calif.
RATE OF HYDROGEN ABSORPTION BY COPPER
S. Imoto et al Sep. 1969 18 p refs Transl. into ENGLISH from Nippon Kinzoku Gakukaishi (Sendai City), v. 20, 1956 p 221–224 Presented at the Japan Inst. of Metals Meeting,

Kanazawa, Japan, Oct. 1955 Prepared for Calif. Univ., Livermore. Lawrence Radiation Lab.
(PB-190503T; UCRL-Trans-10380) Avail: NTIS CSCL 11F

Absorption rates of hydrogen by copper specimens containing 0.25 per cent and 1.0 per cent oxygen, respectively, at various temperatures (350 to 700 C) were measured. In 0.25 per cent oxygen copper specimens, the amount of absorbed hydrogen increased with time rather linearly than quadratically, especially at higher temperatures. The relation between the logarithm of the initial rate and the reciprocal of absolute temperature was almost linear and the activation energy was deemed to be 18 kcal/mol, which was near the activation energy of diffusion of hydrogen in thin copper plate. The rate-determining step of absorption is looked upon as the diffusion of hydrogen, and it is supposed that grains of cuprous oxide are only reduced by interaction with hydrogen which have reached there. In 1.0 per cent oxygen copper specimens, irregularly reduced parts were observed in much deeper places besides the normally topochemically reduced parts.
Author (USGRDR)

N71-11698# Virginia Univ., Charlottesville. Dept. of Physics.

MECHANICAL PROPERTIES OF METALS AT DIFFERENT TEMPERATURES BY THE CENTRIFUGAL METHOD Final Report, 22 Jan. 1963 – 30 Jun. 1970

Jesse W. Beams 1970 6 p refs
(Grants DA-ARO(D)-31-124-G419; DA-ARO(D)-31-124-G801; DA-ARO(D)-31-124-G996)
(AD-711582; AROD-4036-3-MC) Avail: NTIS CSCL 11/4

The mechanical properties of small iron and other ferromagnetic crystals and whiskers were studied by means of high-speed centrifugal techniques. A brief summary of the results and a listing of documents generated by the research are given. Author (TAB)

N71-11738# Naval Research Lab., Washington, D.C. Metallurgy Div.

FRACTURE RESISTANCE CHARACTERISTICS OF Ti-6Al-2Mo AND Ti-6Al-4V IN 3 in. THICK SECTIONS

R. W. Judy, Jr., R. W. Huber, R. J. Goode, and C. N. Freed Aug. 1970 21 p refs
(AD-711586; NRL-MR-2156) Avail: NTIS CSCL 20/12

The fracture resistance properties of Ti-6Al-2Mo (6-2) and Ti-6Al-4V (6-4) alloys in 3 in. (7.6 cm) rolled plate section were investigated using the Dynamic Tear (DT) test and fracture mechanics tests, together with associated Ratio Analysis Diagram (RAD) procedures. The subject materials were low-oxygen ($O_2 <$ 0.08 wt percent) alloys rolled from 12,000 lb. (5450 kg) ingots; the 6-2 alloy was beta forged and beta rolled from 2050F (1120C) while the 6-4 alloy was beta forged at 2050F (1120C) and alpha-beta rolled at 1750F (970C). Full-thickness DT tests and standard 1 in. DT tests of specimens at plate surface and center locations of both plates in the as-rolled condition revealed considerable anisotropy with respect to fracture resistance for both plates. A high degree of variation of toughness properties through the thickness of the as-rolled plates was also recorded.
Author (TAB)

N71-12003# Bureau of Mines, Rollo, Mo. Metallurgy Research Center.

PRECIPITATION STRENGTHENING OF Pb-Cd-Sb ALLOYS

M. M. Tilman [1970] 12 p refs
(BM-RI-7453) Avail: Issuing Activity

The precipitation strengthening of lead-base alloys containing 0.5 through 4 weight-percent combined Cd plus Sb is discussed. The Cd and Sb were alloyed in a 1-to-1 atomic ratio which maintained compositions along the quasi-binary section Pb-CdSb. Tensile properties, creep rates, and stress-rupture values were obtained on alloys in the aged condition. The highest tensile strength was observed in an alloy of Pb-3 CdSb. Author

N71-12004# Bureau of Mines, Rolla, Mo. Metallurgy Research Center.

A TORSION CREEP TESTER FOR METALS AND ALLOYS USING ELECTROMECHANICAL AND SERVOMECHANICAL INSTRUMENTATION

Alfred E. Schwaneke, Vernon R. Miller, and Robert W. Nash [1970] 15 p refs
(BM-RI-7456) Avail: Issuing Activity

A versatile torsion creep tester with electromechanical and servomechanical components to operate automatically and unattended, producing digital printed outputs is described. The apparatus uses an electrical system for applying torsional stresses, and a unique angular transducer as a null detector operating a servocontrolled strain measuring system with the digital readout. The tester is designed to measure the creep in single-crystal or polycrystalline zinc, zinc alloys, magnesium, magnesium alloys, or other metals and alloys. Applied stresses may be varied from zero up to 2,000 psi in the outermost fibers of a 1/8-inch-diameter, 4-inch-long specimen. Strain readings at 0.001 degree may be made automatically from one every 5 seconds to one per month. The apparatus has provisions for programed temperature control and special atmospheres or vacuum operation. A discussion of applications of the system to other mechanical testing apparatus is included. Author

N71-12025# Technische Hogeschool, Delft (Netherlands). Lab. voor Technische Mechanica.

AN EXPERIMENTAL AND THEORETICAL INVESTIGATION OF CREEP UNDER UNIAXIAL STRESS OF A Mg ALLOY

J. H. Lambermont and J.F. J. F. Jul. 1970 45 p refs
(WTHD-22; Rept-437) Avail: NTIS

A multiaxial analytic creep theory capable of describing primary, secondary, and creep recovery is reviewed and extended. The theory is based on a generalization of Maxwell's rheological creep model to multiaxial stress states. About 50 carefully controlled tensile creep tests on MgAl3ZnF25 at 150 C under step loadings are presented and tested against theory. Reasonable agreement between the rheological model and experiment is obtained.
Author

N71-12063# Brown Univ., Providence, R.I. Div. of Engineering.

INELASTIC DEFORMATION OF AN ALUMINUM ALLOY UNDER COMBINED STRESS AT ELEVATED TEMPERATURE

G. M. Brown Jul. 1970 37 p refs
(Contract N00014-67-A-0191-0003)
(AD-712047; TR-10) Avail: NTIS CSCL 11/6

Biaxial stress tests were performed on thin wall tubes of polycrystalline 2024-T81 Aluminum at temperatures of 150 and 250C. The nominal metallurgical stabilization temperature for this alloy is 190C. Transient and steady state creep strain rates exhibited a considerable depenence on load path history. For a prescribed history it is possible to determine unique surfaces of constant creep strain rate. For the zero history, involving a single loading from the origin to a prescribed point in stress space, surfaces of constant steady state strain rate, at elevated temperature, have the same shape as room temperature yield surfaces of moderate offset. In the temperature and small strain regions considered here, room temperature yield surfaces were found to be unaffected by elevated temperature deformation. The changes in shape of room temperature yield surfaces, due to room temperature plastic deformation caused corresponding changes in the elevated temperature surfaces of constant steady state creep rate. At a given stress point, an outward local motion of the yield surface resulted in a corresponding outward local motion of the steady state creep rate surfaces. The experimental determination of surfaces of constant flow potential was also attempted. Author (TAB)

N71-12111# Atomics International, Canoga Park, Calif.

THE EFFECTS OF HELIUM ON HIGH-TEMPERATURE DUCTILITY OF SANDVIK 12R72HV AND INCO IN-744X

D. Kramer, K. R. Garr, C. G. Rhodes, and A. G. Pard 24 Jun.

1970 17 p refs
(Contract AT(04-3)-824)
(AI-AEC-12960) Avail: NTIS

Small tensile samples of Sandvik 12R72HV and Inco IN-744X were injected with helium by means of alpha-particle irradiation from a cyclotron to produce approximately uniform concentrations of from 1 × 0.000001 to 2.5 × 0.00001 atom fraction. The samples were subsequently tensile tested in vacuum between 500 and 800 C. Sandvik 12R72HV is significantly more resistant to helium embrittlement than types 304 or 316 stainless steel. Helium in Inco IN-744X has little effect on the superplastic behavior of this alloy. Author (NSA)

N71-12126# National Aerospace Lab., Amsterdam (Netherlands).
HEAT TREATMENT STUDIES OF ALUMINUM ALLOY TYPE 7079 FORGINGS
H. P. van Leeuwen and L. Schra Jul. 1969 17 p refs
(NLR-TR-69058-L) Avail: NTIS

The effects of variations in the heat treatment were studied with regard to various properties. The variations involved duration of solution heat treatment, quench rate, temperature and duration of primary and secondary aging. The properties comprised short time tensile strength, fatigue endurance, fatigue crack propagation resistance, fracture toughness and stress corrosion resistance. The results can be correlated on the basis of studies regarding the effect of heat treatment on microstructure. Author

N71-12138# Iowa State Univ. of Science and Technology, Ames.
HEAT CAPACITY OF SCANDIUM FROM 6 TO 350 DEG K
B. C. Gerstein, W. A. Taylor, W. D. Shickell, and F. H. Spedding [1969] 24 p refs Presented at the 8th Rare Earth Conf., Reno, Nev.
(CONF-700403-6) Avail: NTIS

The heat capacity of scandium was measured from 6 to 350 K. The results differ from previous measurements in this temperature range by more than the accuracies of the measurements. The difference is discussed in terms of impurity effects. The thermodynamic functions are tabulated for the range studied. Author (NSA)

N71-12149# National Science Foundation, Washington, D.C.
INVESTIGATION OF DIFFUSION IN THE IRON-ALUMINUM SYSTEM OVER A WIDE RANGE OF CONCENTRATIONS [ISSLEDOVANIE DIFFUZII V SISTEME ZHELELO-ALYUMINII V SHIROKOM INTERVALE KONTSENTRATSII]
J. D. Gertsriken et al 1970 23 p refs Transl. into ENGLISH from Issled. Zharoproch. Splavam, Akad. Nauk SSSR, Inst. Met. (USSR), v. 3, 1958 p 68–76
(TT-70-57046; DMDC-2849) Avail: NTIS CSCL 11F

The study of diffusion process in alloys of the iron group is of scientific and practical interest. Due to the complex interaction of d- and s-electrons in the formation of alloys of the above-mentioned elements, the character of interatomic reaction changes considerably. The characteristics of alloys obtained by different methods enables us to judge clearly the character of interaction and its change in a wide range of concentrations. The aim of the present paper is to establish relations between the parameters of diffusion and the quantities which characterize the interatomic bond. Author (USGRDR)

N71-12150# National Science Foundation, Washington, D.C.
SELF-DIFFUSION OF NIOBIUM IN SINGLE CRYSTAL AND MOLTEN SPECIMENS [SAMODIFFUZIYA NIOBIYA V MONOKRISTALHCHESKIKH I PLAVLENNYKH OBRAZTSAKH]
V. D. Lyubimov et al 1970 15 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Metal. (USSR), no. 5, 1964 p 137–141
(TT-70-57044; DMDC-2706) Avail: NTIS CSCL 11F

Using radioactive Nb, the self diffusion of Nb in both single crystal and molten specimens was undertaken between 1700 and 2100 C. Powder-metallurgically prepared samples of varying density were also studied. Author (USGRDR)

N71-12195# Martin Marietta Corp., Baltimore, Md. Research Inst. for Advanced Studies.
THE MECHANISM OF STRESS-CORROSION CRACKING Final Report, 1 Jul. 1964 – 30 Jun. 1970
E. N. Paugh Aug. 1970 9 p refs
(Contract DA-31-124-ARO(D)-258)
(AD-712327; AROD-5023-12-MC) Avail: NTIS CSCL 11/6

A summary is given of research largely involving the failure of the alpha-brasses in ammoniacal environments, the system which represents the classical example of SCC, viz. season-cracking. TAB

N71-12196# California Univ., Berkeley. Structural Engineering Lab.
QUASILINEARIZATION AND NONLINEAR VOLTERRA INTEGRAL EQUATIONS. 1: COMPUTATION OF CREEP DEFLECTIONS OF METAL STRUCTURES
J. Nestor Distefano and Jerome L. Sackman Dec. 1969 22 p refs
(PB-190638; Rept-69-27) Avail: NTIS CSCL 11F

A quasilinearization technique is developed to treat nonlinear integro-differential equations encountered in a variety of problems involving metal structures undergoing creep deformations. To illustrate the quasilinearization approach to this kin of functional equations, an example involving the computation of the lateral deflections of an axially loaded imperfect bar is developed and thoroughly investigated. The creep law used is given by a nonlinear integral operator incorporating the strain and stress, a function describing the nonlinearity of creep, and a function representative of the rate at which creep occurs. Author (USGRDR)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N71-11391# Princeton Univ., N.J. Polymer Materials Program.
INVESTIGATION OF STRUCTURE-PROPERTY RELATIONS IN SYSTEMATIC SERIES OF NOVEL POLYMERS
John K. Gillham and Mark B. Roller Sep. 1970 52 p refs
(Contract N00014-67-4-0151-0024)
(AD-712069; TR-1) Avail: NTIS CSCL 11/9

Thermomechanical spectra, from -180C to +630C (at a heating rate of 2C/min below 25C and 3C/min above 25C) were generated for the polycarboranesiloxane polymers Dexsil 300 and Dexsil 202 in nitrogen. Thermomechanical experiments were also conducted, from room temperature to 630C in air for both uncured and cured specimens. From the mechanical spectra, separation of the high-temperature thermal and oxidative effects was possible. This work suggested that the last step of the cure cycle proposed for Dexsil 202 is at the threshold of the temperature range corresponding to rapid mechanical changes. The cure cycle needs to be thoroughly investigated. The present data for the polycarboranesiloxane polymers were generated using a newly developed torsional pendulum. A two-component poly(metal phosphinate) system displayed extensive hysteresis in mechanical behavior throughout the temperature range -180C to >300C. Thermal preheatment to about 400C (the limit of thermal stability) eliminated these instabilities. Author (TAB)

N71-11419*# Midwest Research Inst., Kansas City, Mo.
DEVELOPMENT OF LUBRICATING OILS SUITABLE FOR USE WITH LIQUID OXIDIZERS Quarterly Progress Report, 1 Jun. – 31 Aug. 1970
L. W. Breed and R. L. Elliott 31 Aug. 1970 29 p refs
(Contract NAS8-25510; MRI Proj. 3380-C)
(NASA-CR-102907; QPR-3) Avail: NTIS CSCL 11H

The search has continued for fluorinated ester compositions having improved vacuum compatibility and satisfactory pour points and LOX-compatibility. A series of neopentyl polyol esters of psi-alkoxyacetic acid were prepared and screened as fluids for use in grease compositions. Although the evaporation rates of the fluids were considerably lower than those of the psi-alkyl 3-methyl glutarates, oils with much greater viscosities at room temperature and higher pour points were obtained. Two of the experimental fluids had pour points as low as −40 F. Improved viscosity indexes in this series seemed to be related more to the higher viscosities than to the structure itself. When mixed with tricresyl phosphate, the fluids performed satisfactorily on the wear tests. Other fluid compositions based on unsymmetrical esters and on blends of symmetrical esters showed no improvement over the pure esters in their useful temperature range. Author

N71-11441*# General Electric Co., Philadelphia, Pa.
EVALUATION OF OMNIWEAVE (GE) METHOD OF COMPOSITE FABRICATION-GRAPHITE FILAMENT Final Report
M. Wexler, R. Fenton, D. Lowe, H. Edighoffer, and R. Belman 22 Jun. 1970 227 p refs
(Contract NAS8-24777)
(NASA-CR-102916; DOC-705D632) Avail: NTIS CSCL 11D

Twenty-two Omniweave fabrics were woven of S-glass, morganite type 2, Thornel 50S, boron, and mixed fiber combinations of these materials using epoxy prepregged weaving elements to demonstrate the manufacturing feasibility of this weaving approach. Selected composites produced from these multidirectional fabrics were evaluated for flexure, tensile, compression and interlaminar shear properties to note the effect of weave geometry and fiber type on mechanical properties. Analyses were performed using the OMNI computer code to estimate composite properties. Off-axis tensile data obtained on unidirectional S-glass/epoxy composites were used to determine the effective translation of resin/fiber properties to the Omniweave construction. Structural analyses indicated that Omniweave composites of morganite and/or boron can be utilized for structural skin applications at significant weight savings over state-of-the-art materials. Author

N71-11576# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
STRENGTHENING OF METALS AND ALLOYS BY REFRACTORY FIBERS GROWN FROM THE MELT
Herve Bibring, Georges Seibel, and Maurice Rabinovitch 1970 6 p refs Presented at the 2nd Intern. Conf. on Resistance of Metals and Alloys, Asilomar, Calif., 30 Aug. – 4 Sept. 1970 Submitted for publication
(ONERA-TP-853) Avail: NTIS

The role of tantalum carbide fibers in strengthening composite materials and the behavior of the fibers during tensile and creep tests at room temperature and at high temperature are analyzed. ESRO

N71-11588# Laboratoire d'Automatique et de ses Applications Spatiales, Toulouse (France).
RESEARCH ON A THEORETICAL FORMULATION OF SOLID INSULATOR LIFETIME [RECHERCHE D'UNE FORMULATION THEORIQUE DE LA DUREE DE VIE DES ISOLANTS SOLIDES]
Alain Guyetand (Ph.D. Thesis – Toulouse Univ.) Oct. 1968 141 p refs In FRENCH
Avail: NTIS

The lifetime of insulating materials such as polyethylenes, Teflon, Mylar, and epoxy resins has been studied taking into account partial internal discharges using the Weibull theory. The experimental design is presented and theoretical assumptions are made to explain the results which involve the definition of an erosion coefficient. ESRO

N71-11589# Army Materials and Mechanics Research Center, Watertown, Mass. Ceramics Div.
RESIDUAL STRESS DETERMINATIONS IN ALUMINA BODIES
Charles W. Semple Jun. 1970 30 p refs
(AD-712302; AMMRC-TR-70-14) Avail: NTIS CSCL 11/2

Two types of aluminas (AD-94 and Lucalox bars) were subjected to various quenching treatments designed to introduce residual macro surface compressive stresses and act as a strengthening mechanism. The resulting strain fields were characterized by utilizing single- and double-exposure X-ray diffraction techniques. Supplementary investigations including material characterization, X-ray diffraction elastic constant determinations, and transient thermal stress calculations were also conducted. Author (TAB)

N71-11590 National Lending Library for Science and Technology, Boston Spa (England).
INFLUENCE OF ORIENTATION IN SPINNING ON THE STRUCTURE AND PROPERTIES OF DRAWN POLYETHYLENE TEREPHTHALATE FIBRES
R. Schroth 29 May 1970 8 p refs Transl. into ENGLISH from Faserforsch. Textiltech. (Berlin), No. 20, 1969 p 561–564
(NLL-M-9136-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The orientation of polyester filaments is highly affected by the spinning conditions. The effects of orientation in spinning on the performance in drawing, structural characteristics and textile properties of the filaments were investigated. Author

N71-11591# Drexel Univ., Philadelphia, Pa. Dept. of Metallurgical Engineering.
FABRICATION OF COMPOSITES BY DIFFUSION PROCESSING
Taghi Darroudi, Krishna M. Vedula, and Richard W. Heckel Aug. 1970 15 p refs
(Contract N00014-67-A-0406-002)
(AD-711346; TR-4) Avail: NTIS CSCL 11/4

Composite materials containing continuous $NiAl_3$ fibers in an aluminum matrix were grown by solid state diffusion at 600C from nickel wires embedded in aluminum (hot-pressed). The kinetics of formation of the $NiAl_3$ and Ni_2Al_3 phases and the ultimate solid of the nickel terminal solid solution and Ni_2Al_3 phases were studied. The $NiAl_3$-aluminum composite structure was developed by a diffusion treatment of 72 hours at 600C when 0.005 inch nickel wires were used in the starting structure. Although strengths of these composites were low due to grain boundary fracture of the $NiAl_3$, this method of composite fabrication may prove applicable to the fabrication of composites in other alloy systems. Author (TAB)

N71-11608# Naval Ordnance Lab., White Oak, Md.
POLYPYRAZINOQUINOXALINES FROM TETRAAMINOBENZENE AND BIS PHENYLGLYOXALOYL BENZENES
J. M. Augl and W. J. Nrasidlo 22 Jun. 1970 15 p refs
(AD-711796; NOLTR-70-108) Avail: NTIS CSCL 7/3

Two high temperature stable, soluble polymers were synthesized by the reaction of tetraaminobenzene with bis (phenylglyoxaloyl) benzenes. The polymers were characterized and some of their thermal, solubility, and dielectric properties were determined. Both have decomposition temperatures in vacuum of 520 C, but their thermal-oxidative stabilities are not as high as found for a phenylated polyquinoxaline made previously. Their stabilities at 400 C in air are comparable to that of 'H film.' Author (TAB)

N71-11633# Compagnia Italiana Westinghouse, Turin.
FIBER-REINFORCED PLASTIC STRUCTURES [STRUCTURES EN PLASTIQUE REINFORCE PAR DES FIBRES]
D. Miconi *In* AGARD Advanced Technol. for Production of Aerospace Eng. Sep. 1970 18 p refs In FRENCH (See N71-11626 02-28)
Avail: NTIS

Concepts of fiber material composits and illustrations of the advantages of the fibers in relation to conventional materials are given. Particular attention is given to fabrication procedures and calculation methods for these structures. Transl. by E.H.W.

N71-11635# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Materials Lab.
TECHNOLOGY OF MANUFACTURING AND ADVANCEMENT OF TECHNOLOGY FOR TURBINE ENGINE COATINGS
John R. Williamson *In* AGARD Advanced Technology. for Production of Aerospace Eng. Sep. 1970 13 p refs (See N71-11626 02-28)
Avail: NTIS

Advancement in engine coating technology is centered around erosion resistance and coatings to permit increased performance gains for future aircraft engines. Present programs include development of manufacturing techniques for chemical vapor deposition of titanium carbide for erosion protection of titanium blades and vanes in helicopter engines, chrome-aluminum coatings for oxidation resistance of thoria-dispersion strengthened nickel, and various programs for chromium-titanium-silicon coatings for columbium and tungsten/tungsten disilicide coatings for tantalum. Author

N71-11655# Coating and Chemical Lab., Aberdeen Proving Ground, Md.
GLC DETERMINATION OF ACETATE CONTENT OF POLYMERIC MATERIALS Final Report
George Esposito Sep. 1970 15 p refs
(AD-712312; CCL-287) Avail: NTIS CSCL 7/4

The physical and chemical characteristics of synthetic polymers are related to the type and ratio of functional groups distributed throughout the polymer. With polyvinyl chloride-acetate copolymers and cellulose esters, acetate comprises the major ester group commonly incorporated to impart certain desirable properties essential to the proper performance of fabricated products. Many organic coating systems are formulated from resins containing acetate groups. The report describes a GLC procedure for the determination of vinyl acetate in vinyl chloride-acetate copolymers and the acetyl content of cellulose resins. The procedure for the analysis of both types of material follows essentially the same course, namely, saponification and acidification of the polymer, followed by gas chromatography of the liberated acids. Author (TAB)

N71-11656# Army Materials and Mechanics Research Center, Watertown, Mass.
FRACTOGRAPHIC ANALYSES OF DENSIFIED CERAMICS AND GLASS-CERAMICS BALLISTICALLY IMPACTED BY CALIBER .30 M2 PROJECTILES
William D. Long and William A. Brantley Jul. 1970 21 p refs
(AD-712306; AMMRC-TR-70-17) Avail: NTIS CSCL 19/4

Utilizing low magnification, fractographic analyses was conducted on low-temperature densified ceramics and glass-ceramics ballistically impacted by caliber .30 M2 projectiles. From examinations of fracture-exposed surfaces, the macroscopic sequence of ballistic fracture occurring outside the initial conoid was determined and found to be qualitatively similar for both material classes and for impact by both BALL and AP projectiles. Observations indicate that a number of imperfections such as irregularities in as-received specimen surfaces and internal macroporosity induce alterations in ballistic crack fronts. Author (TAB)

N71-11657*# TRW Systems Group, Redondo Beach, Calif.
THERMALLY STABLE LAMINATING RESINS Final Report
E. A. Burns, R. J. Jones, R. W. Vaughan, and W. P. Kendrick 17 Jan. 1970 205 p refs
(Contract NAS3-12412)
(NASA-CR-72633; TRW-11926-6013-R0-00) Avail: NTIS CSCL 11D

The TRW A-type polyimide resin and resin reinforced composites were investigated. Detailed synthesis and characterization studies were conducted which defined a realistic mechanism of pyrolytic polymerization employing model compounds and identified a superior A-type polyimide formulation from six candidate prepolymers and polymers. E-glass laminate processing and characterization studies employing the identified polyimide formulation, were conducted together with studies of high performance, high modulus graphite reinforced composites. Author

N71-11663# Army Materials and Mechanics Research Center, Watertown, Mass.
CERAMIC WEAR-RESISTANT COATING FOR ALUMINUM
William D. Long Jul. 1970 19 p refs
(AD-712305; AMMRC-TR-70-15) Avail: NTIS CSCL 11/3

Initial wear test results for flame-sprayed, plasma-sprayed, and slurry-coated 6061-T6 aluminum alloy samples are reported. Optical photomicrographs of coating cross-sections are also presented. Author (TAB)

N71-11664# Army Materials and Mechanics Research Center, Watertown, Mass.
MICROSTRUCTURAL AND FRACTOGRAPHIC STUDIES OF BORON CARBIDE SUBJECTED TO BALLISTIC IMPACT AND STATIC FLEXURAL LOADING
William A. Brantley Aug. 1970 28 p refs
(AD-712307; AMMRC-TR-70-18) Avail: NTIS CSCL 19/4

Microstructural and fractographic studies were conducted on hot-pressed boron carbide ceramics subjected to ballistic impact by caliber .30 AP M2 projectiles and static flexural loading. A variety of observational techniques were employed, including conventional metallographic and low-power optical examinations, electron microprobe analysis, scanning electron microscopy, and replication electron microscopy. Results suggest that macroscopic topography of fracture-exposed surfaces is indicative of stress states occurring during the fracture event whereas microscopic topography is determined by microstructural constituents, particularly secondary phases, pores, and grain boundaries. Author (TAB)

N71-11686*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A REVIEW OF CARBON FIBER REINFORCED METAL MATRIX COMPOSITES: THE POTENTIAL OF LARGE-DIAMETER CARBON-BASE MONOFILAMENTS
David L. McDanels 1970 47 p refs Presented at ASTM Natl. Conf. on High Performance Fibers Properties, Appl., and Test Methods, Williamsburg, Va., 17–18 Nov. 1970
(NASA-TM-X-52922; E-6048) Avail: NTIS CSL 11D

While currently available carbon-base yarns are being used to effectively reinforce resin matrices, their small diameter and multifiber form makes metal matrix composite fabrication difficult. Large-diameter carbon-base monofilaments specifically designed for

reinforcement of metal matrix composites are considered. The two methods, pyrolytic deposition on a carbon substrate and resin impregnation followed by pyrolysis, are described. Both methods show promise for producing large-diameter monofilaments which may help reduce the problems of fabrication and compatibility encountered in previous carbon-reinforced metal matrix composites.
Author

N71-11735# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OXIDATION OF LITHIUM GREASES
I. G. Fuks et al 17 Nov. 1969 13 p refs Transl. into ENGLISH from Neftepererab. Neftekhim., Akad. Nauk Ukr. SSR, Respub. Mezhvedom. Sb. (Kiev), no. 11/12, 1968 p 9–13
(AD-711476; FTD-MT-24-299-69) Avail: NTIS CSCL 11/8

One of the most important properties of greases is their chemical stability. A study was launched on the effect of grease composition on oxidizability and changes in lubricant structure and properties from thoroughness of oxidation. The study was limited to consideration of the chemical stability of non-inhibited products. It was found that lithium greases oxidized under a quartz lamp for 8 to 32 hr (thin layer at increased temperature) act similarly to oils and all factors accelerating oxidation of oil, such as ultraviolet radiation, copper catalysis, temperature and duration of use are analogous for greases. Lithium soaps essentially influence the oxidation of oils and the catalytic action of the thickener depends on its concentration and the chemical nature of the oil. Oxidation of lithium greases is accompanied by decrease in stability and drop point, and greater volatility.
Author (TAB)

N71-11936# Forest Products Lab., Madison, Wis.
TENSILE STRESS-STRAIN BEHAVIOR OF FLEXIBILIZED EPOXY ADHESIVE FILMS
W. T. Simpson and V. R. Soper Mar. 1970 12 p refs
(FPL-126) Avail: Issuing Activity

Films of several flexibilized epoxy adhesives were cast and the tensile stress-strain behavior was determined. The modulus of elasticity, maximum tensile stress, strain at failure and work to failure were measured. The maximum stress and the modulus of elasticity decreased in an approximately linear manner with flexibilizer content. A polysulfide flexibilizer definitely increased values for both strain at failure and work to failure. Polyamide, flexible epoxy and mercaptan-terminated polybutadiene flexibilizers showed very little effect on strain at failure and work to failure. These results demonstrate that the mechanical properties of epoxy adhesives can be manipulated. If the required mechanical performance for a specific end use can be defined, it should be possible to engineer a suitable epoxy formulation for specific use.
Author

N71-11970# North Carolina State Univ., Raleigh.
DESIGNING AN OPTIMUM THIN BUMPER ON ARMOR PLATES
Yasuyuki Horie Aug. 1970 28 p refs
(Contract N00014-68-A-0187; Proj. Dynamic Material Response)
(AD-712074; TR-70-3) Avail: NTIS CSCL 19/4

Considering the normal impact of a flat-headed object, it is shown that varying impedance mismatch one can maximize a characteristic response of a thin bumper on armor plates. The criterion is that the best impedance ratio of a thin bumper to a backing plate is .29. This indicates that the combinations such as duralumin-steel and ceramics-steel are very close to the optimum.
Author (TAB)

N71-11972# Dayton Univ. Research Inst., Ohio.
ON THE RESPONSE OF MIXED MATERIALS TO ONE-DIMENSIONAL SHOCK WAVES
Alan K. Hopkins (M.S. Thesis--AFIT) Wright-Patterson AFB, Ohio AFML Jul. 1970 17 p refs
(Contract F33615-68-C-11380)
(AD-712062; AFML-TR-70-158) Avail: NTIS CSCL 11/4

An experimental investigation was conducted to study the response of copper-polyethylene solid mixtures to one-dimensional impacts at .5 to 2.5 km/sec using 12.7 mm and 13.7 mm projectiles. Small bore powder guns are shown to be capable of producing reasonably accurate Hugoniot data. A simple ideal mixing theory for describing the behavior of solid mixtures under shock loading was evaluated and found to be valid within the limits of experimental data scatter. The free surface velocity approximation is shown to break down under conditions where target materials undergo phase transformations. Acoustic velocities in mixtures can be accurately predicted by the mixing theory.
Author (TAB)

N71-12015# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
USE OF FOAM PLASTICS FOR PREVENTING SEASONAL GROUND FREEZING
A. I. Priymak 1970 9 p ref Transl. into ENGLISH from the publ. 'Seasonal Melting and Freezing of Ground in the Northeastern USSR' p 99–105
(AD-711905) Avail: NTIS CSCL 13/3

The report describes experimental efforts to install foam plastics in excavations to act as thermal protection against freezing.
TAB

N71-12018# Texas Univ., Austin. Engineering Mechanics Research Lab.
VARIATIONS IN THE CRUSHING STRENGTH OF PAPER HONEYCOMB Final Technical Report, Aug. 1967–Dec. 1969
E. A. Ripperger and W. R. Briggs Natick, Mass. Natick Labs. Dec. 1969 53 p refs
(Contract DAAG17-67-C-0189)
(AD-711557; USA-NLABS-TR-70-57-AD) Avail: NTIS CSCL 13/4

To determine why paper honeycomb pads, in which variables such as paper weight, cell size, cell shape, and glue line widths are ostensibly constant, sometimes vary rather widely in crushing strength, thirty one precisely controlled samples were fabricated in the laboratory and crushed under dynamic loading. Results of these tests are compared in variation with corresponding results of tests of commercial honeycomb. It appears that crushing failure is governed by random processes having to do with buckling patterns, and blowout. Studies are also reported of the air pressure developed in the cells during crushing, the effect on crushing strength of specimen size and the ratio of crushing area to total specimen area, and the crushing strength at very low crushing rates.
Author (TAB)

N71-12054# Pennsylvania State Univ., University Park. Materials Research Lab.
MATERIALS PREPARATION AND CHARACTERIZATION Annual Technical Progress Report, 1 Jul. 1969–30 Jun. 1970
Aug. 1970 169 p refs
(Contract DA-49-083-OSA-3140)
(AD-711820) Avail: NTIS CSCL 20/12

The report brings together short reports on the research of all faculty affiliated with the Materials Research Laboratory at the Pennsylvania State University. The survey covers, but is not limited to, the research supported by the Advanced Research Projects Agency. It singles out certain classes of materials receiving special attention as follows: Preparation of materials, Characterization of materials, Properties of materials, Noncrystalline solids including glasses, Solid state geoscience and biosciences.
TAB

N71-12086 Joint Publications Research Service, Washington, D.C.
INFLUENCE OF SOLID SURFACE ON RELAXATION

CROSSLINKING PROCESSES IN POLYMER BOUNDARY LAYERS

Yu. M. Malinskiy 30 Oct. 1970 36 p refs Transl. into ENGLISH from Usp. Khim. (Moscow), v. 39, no. 8, Aug. 1969 p 1511–1535
(JPRS-51683) Avail: NTIS

Data on distinctive features of the properties, particularly the crystallization properties, manifested by low-molecular substances in boundary layers are examined. The methods and results of determination of the thicknesses of boundary layers of solutions and fusions of many polymers are presented. Data on the influence of a solid surface on the rate of relaxation processes and the properties of polymers caused by them are generalized. The influence is examined of artificial nucleus-formers on the structure (and properties) of polymers, the suppression of crosslinking in thin films in certain systems, and epitaxy. The cited experimental data are treated from the point of view of concepts of the bundle structure of polymers and of the influence of interactions between a solid surface and the polymer on the enthalpy and entropy of the system. Author

N71-12091# National Bureau of Standards, Boulder, Colo. Cryogenics Div.

ADVANCES IN THERMAL INSULATION

R. H. Kropschot 1970 14 p refs Presented at Cryog. Eng. Conf., Bouler, Colo., 17-19 Jun. 1970 Submitted for publication
Avail: Issuing Activity

Recent developments in thermal insulation which have significant impact upon the cryogenic industry are highlighted. The need for future experiments which provide data more completely is discussed, and a standard apparatus is examined which can be used for determining the relative merits of insulation systems. Finally, the requirements for a reproducible standard sample are presented and some major deficiencies in insulation development for aerospace applications are suggested. E.M.C.

N71-12113# Bureau of Mines, College Park, Md. Metallurgy Research Center.

YTTRIA AND DYSPROSIA AS HIGH-TEMPERATURE THERMISTOR MATERIALS

Garrett R. Hyde, Edwin E. Maust, Jr., and Le Roy R. Furlong Dec. 1970 11 p refs
(BM-RI-7458) Avail: NTIS

Sintered yttria and dysprosia can be used to make single-component thermistors having typical thermistor geometries and operable in the temperature range 500 to 1,200 C. However, at these temperatures, instability of platinum electrodes can contribute a slight aging effect if the thermistor is kept near 1,200 C for long periods. Typical characteristics at 500 C for an yttria disk thermistor 12 mm in diameter and 2 mm thick are a resistance of 12.4 megohms and a temperature coefficient of resistance of -3.8 percent per degree C. Typical characteristics at 500 C for a dysprosia thermistor of the same dimensions are a resistance of 1.84 kohms and a temperature coefficient of resistance of -1.6 percent per degree C. Author

N71-12114# Bureau of Mines, College Park, Md. Metallurgy Research Center.

SURFACE AREAS OF THERMALLY TREATED CADMIUM SULFIDE POWDERS

Roy L. Wilfong and Garrett R. Hyde Dec. 1970 18 p refs
(BM-RI-7460) Avail: NTIS

Surface area measurements were conducted on cadmium sulfide powders following thermal treatments at temperatures up to 500 C and treatment times up to one week. Thermal treatments at temperatures up to 300 C produced no significant changes in the surface area of the powders even after one week of exposure. At 500 C some decomposition of the cadmium sulfide occurred. Author

N71-12176# Battelle Memorial Inst., Columbus, Ohio.

APPROXIMATE THREE THREE-DIMENSIONAL STRESS SOLUTIONS FOR SOME LAMINATED PLACE PROBLEMS USING A HIGHER ORDER EQUILIBRIUM FINITE ELEMENT MODEL. PART 1: PRELIMINARY INVESTIGATIONS Technical Summary Report, 1 Nov. 1969 – 31 May 1970

Edmund F. Rybicki Wright-Patterson AFB, Ohio AFML Aug. 1970 51 p refs
(Contract F33615-70-C-1117)
(AD-711399; BAT-G9731-1-Pt-1; AFML-TR-70-201-Pt-1) Avail: NTIS CSCL 11/4

A preliminary investigation of a method for obtaining approximate three-dimensional stress solutions for some laminated plates is presented. The laminates are three-ply symmetric lay-ups. The material of each lamina is orthotropic and homogeneous. The stress-strain relations are linear and the behavior is the same in tension as compression. Displacement and stress boundary conditions are considered. The method of analysis utilizes the complementary energy formulation and a higher order three-dimensional finite element representation for the Maxwell stress functions. Equilibrium within each material and between distinct materials is satisfied exactly. Stress boundary conditions and stress-strain relations are satisfied exactly. Compatibility and displacement boundary conditions are satisfied approximately. One element per lamina is used. This representation yields from 216 to 600 unknowns depending on the boundary conditions. A computer program based on the method of analysis was developed. Results for selected laminates are presented and discussed. Author (TAB)

N71-12177# Utah Univ., Salt Lake City. Coll. of Engineering.

THERMAL DECOMPOSITION OF HIGH-TEMPERATURE RESISTANT POLYMERS

Norman W. Burningham and J. D. Seader Jul. 1970 287 p refs
(Contract F44620-68-C-0022; Proj. Themis)
(AD-711400; THEMIS-UTEC-TH-70-085; AFOSR-70-1936TR)
Avail: NTIS CSCL 11/9

The thermal response of several test materials was characterized by isothermal and dynamic thermogravimetric analysis. Pyrolysis gas analysis, infrared spectra analysis and elemental analysis were employed also to formulate a description of the thermal-degration reaction. A new, systematic approach to the determination from dynamic TGA data of kinetic parameters describing pyrolysis was developed. The specific polymeric materials selected for evaluation in this program were chosen from those representing the forefront of high-temperature polymer technology. Samples of linear para-polyphenylene, polybenzimidazole, polyimide, phenylated polyquinoxaline and phenolic resins were tested. Pyrolysis kinetic parameters were determined for polyphenylene, polyimide and polyquinoxaline. Similar parameters were not determined for phenolic and polybenzimidazole resins since the analytical method was not sufficiently developed to permit handling of their complex thermograms. Author (TAB)

N71-12191# Royal Aircraft Establishment, Farnborough (England).

PROPERTIES OF CARBON FIBRES

Toshio Shimizu, et al Dec. 1969 22 p refs Transl. into ENGLISH from Nat. Tech. Rep. (Matsushita Elec. Ind. Co. Osaka (Osaka), v. 7, no. 3, 1961 p 320–329
(RAE-Lib-Trans-1417) Avail: NTIS

Carbon fibers were prepared by pyrolysis of straight PAN (Polyacrylonitril) fibres and Orlon-type PAN fibres. Effects of heat treating temperature on the properties were investigated. Carbon fibres treated at 1000 C showed tensile strength of 8000-10000 kg/sq cm, Young's modulus of 7000-10000 kg/sq mm and specific resistance of 4 × 0.001 omega cm at 20 C. These mechanical properties are comparable to the properties of glass fibre. Carbon fibre cloth and string were also prepared, and their electrical and mechanical properties were measured. Author

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N71-11172# Southwest Research Inst., San Antonio, Tex.
DEVELOPMENT OF A GENERAL FINITE DIFFERENCE APPROXIMATION FOR A GENERAL DOMAIN. PART 3: A DIRECT AND REVERSE SUCCESSIVE OVERRELAXATION METHOD Final Report
Wen-Hwa Chu 28 Nov. 1970 33 p refs
Avail: NTIS

A direct and reverse successive overrelaxation procedure was developed and found successful in many applications. A general sufficient condition for convergence of this procedure has been derived. In addition, a preliminary investigation on this procedure with underrelaxation of selected off-diagonal terms has been made, although only a preliminary condition of convergence has been reached. Its application to a general second-order elliptic differential equation through machine transformation is illustrated. Possible future research problems related to this procedure are discussed. Author

N71-11405*# Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.
NECESSARY CONDITIONS FOR JOINING OPTIMAL SINGULAR AND NONSINGULAR SUBARCS
J. P. McDaniel and W. F. Powers Apr. 1970 24 p refs
(Grants NGR-23-005-329; NSF GK-4990)
(NASA-CR-108664) Avail: NTIS CSCL 12A

Necessary conditions for the optimality of junctions between singular and nonsigular subarcs are developed for singular optimal control problems. Previously known necessary conditions concerning the continuity and smoothness of a piecewise analytic optimal control at a junction are clarified and extended. The main result is that the sum of the order of the singular arc and the lowest order time derivative of the control which is discontinuous at the juntion must be an odd integer when the strengthened generalized Legendre – Clebsch condition is satisfied. Also, necessary conditions which do not require an analyticity assumption are developed. These aid in characterizing problems which may possess nonanalytic junctions. Author

N71-11468# Danish Research Centre for Applied Electronics, Copenhagen.
EMPIRICAL ITERATION: COOPERATION BETWEEN COMPUTERS, LABORATORY OR WORKSHOP [EMPIRISK ITERATION: SAMVIRKE MELLEM DATAMASKINE, LABORATORIUM OG VAERKSTED]
J. H. Wested Sep. 1970 43 p In DANISH; ENGLISH summary
(ECR-17) Avail: NTIS

The report describes a semi-empirical technique developed for the achievement of a mechanical design, the optimization of a process, or the construction of a model of a system, etc., based on design criteria that cannot be given in a known analytical representation or are characterized by a number of unknown parameters in a mathematical formula. The model achieved from this technique is successively refined by modifying the parameters or expanding the representative formula by means of new functions with new parameters. The evaluation of the parameters or the validity of the chosen mathematical presentation and the succeeding modifications of the model is called empirical iteration. In empirical iteration the specified data are compared with the results of measurements on provisional models designed from the formula from the preceding step in the process. The model is changed in accordance with the result of this comparison. Author

N71-11605# RAND Corp., Santa Monica, Calif.
CONVERGENCE OF THE SERIES EXPANSION SOLUTION TO THE THOMAS-FERMI-DIRAC EQUATION
James E. Enstrom Sep. 1970 7 p refs
(AD-712287; P-4444) Avail: NTIS CSCL 12/1

The Thomas-Fermi-Dirac statistical model has been used for approximate calculations of potential fields and charge densities. It has also been used to derive the equation of state of matter at high pressures and at various temperatures. The second-order nonlinear differential equation which results from the model can only be solved numerically. This is most accurately done by expressing the solution as a power series expanded about the origin. But beyond a certain radius the series diverges and the solution must be continued by numerical integration. The convergence of the power series solution is studied in order to determine precisely the region in which it is accurate. Author (TAB)

N71-11606# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
AN APPROXIMATE FOURIER INTEGRAL TRANSFORM METHOD FOR ANALYSIS OF WAVE PROPAGATION SIGNALS
Hal Watson, Jr. 13 Jul. 1970 41 p refs
(Contract N00014-68-A-0515; Proj. Themis)
(AD-711798; THEMIS-SMU-TR-73) Avail: NTIS CSCL 12/1

An analytical-numerical method of obtaining integral Fourier and inverse integral Fourier transforms is discussed. The technique was used to obtain the approximate transforms of functions, the real transforms of which are known. Author (TAB)

N71-11607# Brown Univ., Providence, R.I. Center for Dynamical Systems.
STOCHASTIC CONTROL FOR SMALL NOISE INTENSITIES
Wendell H. Fleming Apr. 1970 116 p refs
(Grants AF-AFOSR-0693-67A; NSF GP-6733)
(AD-712370; CDS-TR-70-1) Avail: NTIS CSCL 12/1

The paper is concerned with the approximate solution of some stochastic optimal control problems. The models of control systems considered are perturbations of the deterministic optimal control model of Pontryagin. It is assumed that, in the stochastic problem, the system is perturbed by random disturbances which take the form of an additive white noise term in the system equations. If the noise coefficient Sigma is small, it is reasonable to seek an approximate solution of the stochastic problem in terms of quantities computable from the Pontryagin problem. The given statements are proved in terms of singular perturbation of the Hamilton-Jacobi equation by a small second order term. Author (TAB)

N71-11609# Laboratoire d'Automatique et de ses Applications Spatiales, Toulouse (France).
CONTRIBUTION TO THE ANALYSIS OF SAMPLED DATA SYSTEMS USING ASSOCIATED RECURRENCES [CONTRIBUTION A L'ANALYSE DE SYSTEMES A DONNEES ECHANTILLONNEES A L'AIDE DES RECURRENCES ASSOCIEES]
Jean-Louis Abatut (Ph.D. Thesis—Toulouse Univ.) Toulouse Univ. 1970 131 p refs In FRENCH Sponsored by Direc. des Rech. et Moyens d'Essais
Avail: NTIS

The aim of this work is to show that certain theoretical results on properties of recursive functions have in fact a physical meaning and particularly that certain properties of the solutions of recursive functions may well help to explain complex phenomena met in systems described by such functions. Starting from these results three problems are dealt with: (a) performances of a sampled data system when the sampling duration is not zero, (b) analysis of critical cases and of cases where an exception appears for a second order sampled system, and (c) complex oscillations (nearly periodic, low frequency) that can appear in such systems. ESRO

N71-11610# Laboratoire d'Automatique et de ses Applications Spatiales, Toulouse (France).
CONTRIBUTION TO THE STUDY OF THE SOLUTIONS ON NONLINEAR RECURRENCES AND DIFFERENT APPLICATIONS [CONTRIBUTION A L'ETUDE DES SOLUTIONS DES RECURRENCES NON LINEAIRES ET DIFFERENTES APPLICATIONS]
Jean-Pierre Babary (Ph.D. Thesis—Toulouse Univ.) Toulouse Univ. 1969 180 p refs In FRENCH Sponsored by Direc. des Rech. et Moyens d'Essais
Avail: NTIS

An explicit solution to the boundary of the stability field of an equilibrium point defined by an autonomous second order real variable recursive function the righthand side of which is a monome, is presented. A mathematical formula is established to determine the stability of an equilibrium point the multipliers of which are complex numbers. Results are applied to sampled data systems with linear and nonlinear reactions. ESRO

N71-11611# Technical Univ. of Norway, Trondheim. Dept. of Production Engineering and Machine Tools.
ALGEBRAIC TOPOLOGY IN MANUFACTURING SYSTEMS
Oeyvind Bjoerke Jun. 1969 37 p Presented at the CIRP Meeting, Geneva, Sep. 1969
Avail: NTIS

A presentation is given of some of the concepts in algebraic topology, which have shown to be useful in making computer systems for automatic selection of machining methods. A detailed example is given of the use of group theory. Finally some indications for applying algebraic topology to a practical problem are given. ESRO

N71-11658# Compagnie Francaise Thomson Houston-Hotchkiss Brandt, Paris. Groupe Prospective.
RELEVANCE TREES [ARBRES DE PERTINENCE]
L Gerardin 28 May 1970 25 p refs In FRENCH
(LG/PB-LCR/DR2-554/70) Avail: NTIS

Relevance trees are used as a general method for the definition of programs. A description is given of how to build them, their applications, and the difficulties encountered when using them. The methods employed to partition a graph and transform it to relevance trees is also described. ESRO

N71-11659# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
THE INTERIOR BOUNDARY VALUE PROBLEM FOR BOLTZMANN EQUATION [PROBLEME AUX LIMITES INTERIEUR POUR L'EQUATION DE BOLTZMANN]
Jean-Pierre Guiraud (Paris Univ.) 1970 10 p refs In FRENCH; ENGLISH summary Presented at the Intern. Mathematicians Congr., Nice, 1–9 Sep. 1970 Submitted for publication
(ONERA-TP-865) Avail: NTIS

The interior boundary value problem for Boltzmann equation has been solved previously. This solution was obtained in a Hilbert space of square integrable functions of the space variable, having their value in a space of square integrable functions of the velocity variable. This is a generalized solution. Some regularity properties of this solution are given here. These properties are just sufficient for dealing with the weakly nonlinear full Boltzmann equation. Author (ESRO)

N71-11660# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
AN ALTERNATIVE TO AN F-TEST ON VARIANCES
Donald Jefferson Wheeler 12 Jul. 1970 68 p refs
(Contract N00014-68-A-0515; Proj. Themis)
(AD-711801; THEMIS-SMU-TR-76) Avail: NTIS CSCL 12/1

The usual F-test on variances has been shown to be non-robust when the underlying populations are not normally distributed. An alternative test for equality of variances is developed and compared with the F-test by means of sampling experiments. This alternative test is shown to be less seriously affected by non-normal populations than is the F-test and a brief comparison of this alternative test and a modified F-test developed earlier is given. Author (TAB)

N71-11686*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SOME APPLICATIONS AND LIMITATIONS OF THE FAST FOURIER TRANSFORM
Edgar Hopper and Murl Newberry 12 Feb. 1970 66 p refs
(NASA-TM-X-53997) Avail: NTIS CSCL 12A

A discussion of power spectral density functions, autocorrelation functions, cross-spectral density functions, cross-correlation functions, and other related functions used in the analysis of a time series is presented. The most direct route from a time series to a spectral density function is the Fourier transform. However, the computer time required to calculate a Fourier transform directly by conventional methods makes this approach impractical. Recent developments in procedures for complex arithmetic make the calculation of Fourier transforms of discrete time series feasible. The direct Fourier transform and fast Fourier transform techniques are evaluated. Examples of theoretical and practical problems are solved and the results are compared to the results from the conventional approach using STAN. Recommendations are made for quick-look analysis of structural vibrations. Author

N71-11736# New South Wales Univ., Kensington (Australia). Dept. of Statistics.
A QUEUEING SYSTEM IN WHICH THE ARRIVAL OF CUSTOMERS IS SCHEDULED
H. G. Herbert (M.S. Thesis) 24 Feb. 1969 123 p refs
Avail: NTIS

The queueing problem in which batches of customers are scheduled to arrive regularly but may arrive late or not at all is considered. The imbedded Markov chain technique is extended to two queueing systems in equilibrium in which the batch latenesses are nonoverlapping, and the customer service time distribution is a negative exponential. The distribution of the idle period for the single server queue in equilibrium with negative exponential customer service time is discussed. J.A.M.

N71-11759# Meiji-Gakuin Univ., Tokyo (Japan). Dept. of Physics.
PROPER TIME FORMULATION WITH GENERAL VERTICES
Chiaki Itoh Jul. 1970 5 p refs
Avail: NTIS

A proper time formulation to derive the N-point Veneziano amplitude is presented. The Schroedinger equation is given and the equation is solved in the interaction representation and the matrix is obtained. The N-point amplitude in the multiperipheral configuration is derived. Author

N71-11765# New South Wales Univ., Kensington (Australia).
ABELIAN SUBGROUPS OF p-GROUPS
Joseph T. Goozeff (M. S. Thesis) 6 Nov. 1968 70 p refs
Avail: NTIS

Results of p-group theory are presented. Theorems for abelian subgroups of p-groups are proven. Large abelian subgroups of p-groups are discussed and the conjecture, if a p-group has an abelian subgroup of a given index, then it has a normal abelian subgroup of the same index, unless p is one of a finite number of primes, is investigated. Author

N71-11937# New South Wales Univ., Kensington (Australia).
FRACTIONAL ITERATION OF FUNCTIONS OF SEVERAL VARIABLES
P.M. Diamond (Ph.D. Thesis) 1968 131 p refs
Avail: NTIS

Some aspects of the fractional iteration of functions of two real or complex variables are presented. Transformations of two complex variables, in the case where the eigenvalues of the linear part are non-zero and of modulus less than one are discussed. It is shown that specific algorithms converge to iterates of T, and that these iterates are identical with those constructed from generalized Schroeder functions. Similar results for real mappings when the eigenvalues are complex are presented. Functions of real variables with both eigenvalues unity and the linear part not diagonalisable are described. The classical problem of invariant curves of such functions is solved. It is shown that whenever the leading coefficients of the invariants are of like sign, fractional iteration is possible. Author

N71-11938# Environmental Science Services Administration, Boulder, Colo. Research Labs.
RECURSION FORMULA FOR THE LOGARITHMIC DERIVATIVES OF SPHERICAL BESSEL FUNCTIONS IN THE COMPLEX PLANE
Richard L. Lewis Jan. 1970 29 p refs
(ESSA-TR-ERL-151-ITS-99) Avail: SOD $0.35

The generation of numerical values for sequentially ordered logarithmic derivatives of three spherical Bessel functions by the recursion formula is considered. For a given quadrant in the right half of the complex-argument (z) plane, the forward recursion formula is found inherently convergent to one of these logarithmic derivatives, while it is found inherently convergent to a different logarithmic derivative in the opposite quadrant. The backward recursion formula converges to the third logarithmic derivative in the entire right-half plane. Therefore, only two of the three functions can be calculated in any given quadrant by the recursion formula. However, the third function can be accurately approximated since it is asymptotically equal to one or the other of the two functions that can be generated by the recursion formula, the choice depending on whether the function's order is less than or greater than an integer function of the argument, N(z). Author

N71-12077# New South Wales Univ., Kensington (Australia).
THE LIMITATIONS OF FORMAL SYSTEMS
Douglas Raymond Busch (M.A. Thesis) 1968 253 p refs
Avail: NTIS

The limitations of formal mathematical systems is discussed. Subjects presented are: (1) the Lowenheim-Skolem theorem, (2) nonstandard models for arithmetic, (3) Godel's incompleteness theorems, (4) intuitionism, modality, and provability, and (5) logicism, nominalism, and arguments for consistency. Author

N71-12170# Joint Publications Research Service, Washington, D.C.
MULTIALTERNATIVE SEQUENTIAL ANALYSIS
A. A. Aglintsev et al 9 Nov. 1970 13 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Tekhn. Kibernetika (Moscow), no. 1, 1970 p 171–180
(JPRS-51739) Avail: NTIS

The problem of sequential testing of many hypotheses concerning the distribution density of an unknown stochastic vector is analyzed with a fixed error probability matrix. An engineering method is suggested for distinguishing the many hypotheses, providing practically insignificant deformation of the error probability matrix. Concrete examples of differentiation of five hypotheses on the normal density of a six-dimensional stochastic vector are solved. Author

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N71-11133# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
NOMOGRAMS FOR CALCULATING TURBULENT HEAT EXCHANGE AND HEAT LOSS BY EVAPORATION
V. A. Shamontev 1970 10 p refs Transl. into ENGLISH from Probl. Arktiki i Antarktiki (USSR), no. 26, 1967 p 39–44
(AD-711916) Avail: NTIS CSCL 4/2

Calculation of turbulent heat exchange and heat loss by evaporation with empirical formulas is a rather long and work-consuming operation, requiring cumbersome computations, consisting of series of successive calculations. To facilitate such calculations it is expedient to use uncomplicated nomograms, which enable us to obtain directly from them the values of heat currents resulting from turbulent heat exchange and evaporation. Such nomograms were used in calculating the heat balance components of one of the Arctic seas for the navigation period. Plotting of such nomograms, connected with the graphic solution of an equation with three unknowns, is based on the method of application of the system of Cartesian coordinates. Author (TAB)

N71-11140# RAND Corp., Santa Monica, Calif.
STUDIES IN CLIMATE DYNAMICS FOR ENVIRONMENTAL SECURITY LARGE-SCALE OCEAN/ATMOSPHERE INTERACTION RESULTING FROM VARIABLE HEAT TRANSFER AT THE EQUATOR
J. Bjerknes Aug. 1970 31 p refs
(Contract DAHC15-67-C-0141; Grant NSF GA-3193; ARPA Order 189-1)
(AD-711308; RM-6353-ARPA) Avail: NTIS CSCL 4/2

A brief investigation is presented of long-term variability of the tropical heat supply of the Pacific Ocean and its influence on the atmospheric circulation. From the record of monthly sea and air temperature at Canton Island, 2 deg 48 min S, 171 deg 43 min W, November 1964 is selected as typifying the arid conditions associated with anomalously cold equatorial water, and as representing a contrast to November 1965 with its near-maximum water temperature and abundant rainfall. Air circulation also differs significantly here. The large-scale effect on the atmosphere from November 1964 to November 1965 is described as a general warming of the complete belt of the tropical troposphere with inherent strengthening of the upper tropospheric westerlies in both hemispheres. Author (TAB)

N71-11171# Woods Hole Oceanographic Institution, Mass.
BOMEX METEOROLOGICAL DATA. PART 1: QUANTITATIVE CLOUD MEASUREMENTS. PART 2: SEA SURFACE TEMPERATURES. PART 3: Final Report
Andrew F. Bunker and Margaret A. Chaffee Sep. 1970 67 p refs
(Grant NSF GA-1700)
(WHOI-70-49) Avail: Issuing Activity

Cloud photographs and sea surface temperature observations were made from the WHOI C-54Q aircraft on eleven flights during the Barbados Oceanographic and Meteorological Experiment (BOMEX) observing period. The cloud images on the time-lapse film have been measured for heights and analysed for cloud amounts and types. Cross-sections of the clouds have been constructed and are presented with photographs from NIMBUS III and ESSA-9 satellites. Charts showing the aircraft tracks, solar radiation received, winds, and showers are presented to aid in the interpretation of the data. No study of the significance of the cloud formations has been made. Sea surface temperatures were measured by a PRT-5 infra-red radiometer from the aircraft. The values obtained have been corrected and averaged by one-degree squares. A chart of the one-degree-square averages is presented. A final report describing the BOMEX flights, data reduction, and distribution of the data is submitted. Author

N71-11407*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
PEAK WIND SPEED ANEMOMETERS (MAXOMETER) Final Report, 26 Mar. 1969 – 26 May 1970
P. T. Johnson and M. C. Krause Jun. 1970 87 p refs
(Contract NAS8-24020)
(NASA-CR-102909; LMSC/HREC-D-162388; HREC-4020-1)
Avail: NTIS CSCL 04B

A peak wind speed recording device with anti-spark properties, capable of measuring winds from 8 to 200 m/sec and keeping a permanent record of the peak wind, was fabricated and tested. The specifications also called for the capability of withstanding the Saturn 5 launch conditions on the umbilical tower and an accuracy design goal of + or − 5% of reading. A maxometer concept utilizing a flat disk and two constant rate springs was designed and developed. The concept included a precision clutching mechanism to retain a given displacement of the springs when exposed to the dynamic pressure generated from a given maximum wind velocity. The tests indicate that the device is capable of meeting the design specifications, except for the low-range dynamic pressure values. Wind tunnel tests in the low range were inadequate to properly evaluate the low-range characteristics because of tunnel facility limitations. Further field and wind tunnel tests are recommended to evaluate the device over the full range of performance characteristics. Minor design changes are also recommended to reduce fabrication costs and to relieve potential operational limitations. Author

N71-11416+ Freie Univ., Berlin (West Germany). Inst. for Meteorology and Geophysics.
METEOROLOGICAL DATA. VOLUME 112, NO. 6 RESULTS OF THE SYNOPTIC SERVICE DURING 1970. DAILY WEATHER MAPS (Ground, 500 mb, 300 mb), AND BRIEF SCIENTIFIC ARTICLES [METEOROLOGISCHE ABHANDLUNGEN. BAND 112/HEFT 6: ERGEBNISSE DES SYNOPTISCHEN DIENSTES IM JAHRE 1970. TAEGLICHE WETTERKARTEN (BODEN, 500 mb, 300 mb) UND KLEINERE WISSENSCHAFTLICHE AUFSAETZE]
Manfred Geb, Leopold Klauser, Richard Scherhag et al 1970 208 p refs In GERMAN
Avail: NTIS

Measurement results of daily radiosonde ascents are shown graphically on meteorological charts of the Northern Hemisphere and depict ground level as well as 500 mb and 300 mb recordings. Included are detailed data tables of precipitation, temperature, and radioactivity measurements over Berlin, Germany; also attached are short studies on weather and snow conditions during the winter 1969/70 in the Berlin area. Transl. by G.G.

N71-11437# Air Weather Service, Scott AFB, Ill.
MEAN CLOUDINESS AND GRADIENT-LEVEL WIND CHARTS OVER THE TROPICS. VOLUME 1: TEXT. PART A: MONTHLY RESULTANT GRADIENT-LEVEL WIND. PART B: AVERAGE MONTHLY CLOUDINESS
Gary D. Atkinson and James C. Sadler (Hawaii Univ.) Aug. 1970 25 p refs
(AD-711655; AWS-TR-215-Vol-1-Pt-A; AWS-TR-215-Vol-1-Pt-B)
Avail: NTIS CSCL 4/2

The report describes method of construction and use of a set of 48 climatological charts being published separately as AWS TR 215, Vol II. The charts are for monthly resultant gradient-level wind and for monthly mean cloudiness, on scale of 1:20 million Mercator. Volume I gives the data source and description of the main features of the charts, their usefulness for forecasters, for training and briefing purposes. The gradient-level chart is used for synoptic analysis and forecasting in the tropics, but the sparseness of data reports makes the climatological charts of special value as an aid in analysis. Available climatological charts being inadequate, a new series was prepared. The mean cloudiness charts serve a similar purpose. This report is an adjunct to a manual on tropical forecasting under preparation in Hqs AWS. Author (TAB)

N71-11447*# Scientific Translation Service, Santa Barbara, Calif.
WAVE CLOUDS ASSOCIATED WITH OBSTACLES, OBSERVED FROM ARTIFICIAL EARTH SATELLITES [VOLNISTYYE OBLAKA PREPYATSTVIY, NABLYUDAYEMYYE S ISKUSSTVENNYKH SPUTNIKOV ZEMLI]
P. B. Smirnova Washington NASA Nov. 1970 9 p refs Transl. into ENGLISH from Tr. Gidrometeorol. Nauchn.-Issled. Tsentr. SSSR (Leningrad), no. 20, 1968 p 30–34
(Contract NASw-2035)
(NASA-TT-F-13364) Avail: NTIS CSCL 04B

A comparatively large number of television pictures of wave clouds associated with obstacles, taken by the Cosmos-122 satellite, are analyzed above mountainous regions in the Urals and eastern Siberia. The characteristic scale of wave movements is determined from the television pictures. Statistical analyses of rawinsonde data on temperature and wind are used as a basis for drawing conclusions regarding the nature of the temperature stratification within the cloud layer and the wind-field pattern in the air layer below the clouds. Graphs are provided which allow use of television pictures of wave clouds to determine the wind speed and direction. Author

N71-11448# Royal Aircraft Establishment, Farnborough (England).
THE TIME SPECTRA OF CERTAIN CHARACTERISTICS OF THE ATMOSPHERE ABOVE THE OCEAN [VREMENNYE SPEKTRY NEKOTORYKH KHARAKTERISTIK ATMOSFERY NAD OKEANOM]
V. I. Byshev and Yu. A. Ivanov Jun. 1970 28 p refs Transl. into ENGLISH from Fiz. Atm. i Okeana (USSR), v. 5, no. 1, 1969 p 17–28
(RAE-LIB-Trans-1472) Avail: NTIS

The fluctuation spectra of air temperature, atmospheric pressure, and wind velocity in the near-sea layer of the Atlantic Ocean were plotted. Data from weather ships and meteorological stations on islands were used. An analysis of the spectra is given and the spectral variation is examined according to the region of the ocean. Author

N71-11464 National Lending Library for Science and Technology, Boston Spa (England).
THE DETERMINATION OF AIR POLLUTION POTENTIAL
E. Ju. Bezuglaja 14 May 1970 15 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 234, 1968 p 69–78
(NLL-M-9129-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Air pollution is discussed in terms of meteorological and emission parameters used in the concept of air pollution potential which indicates the atmosphere's capacity for diffusing impurities. Air pollution potential is high where meteorological conditions unfavorable for the diffusion of impurities occur frequently. The American systems for forecasting inversions and climatic conditions resulting in hazardous pollution conditions are reviewed. The results of studying the air pollution potentials over the Soviet Union show that conditions in which deep inversions are formed, and wind speeds are less than 1 m/sec, are hazardous for large towns. It is concluded that extensive study of the frequency of stability in the lower troposphere and the distribution of light winds with altitude in the boundary layer of the atmosphere is required for a more complete estimate. F.O.S.

N71-11465*# Scientific Translation Service, Santa Barbara, Calif.

CONVECTIVE CLOUD CELLS AS OBSERVED FROM ARTIFICIAL EARTH SATELLITES [KONVEKTIVNYYE OBLACHNYYE YACHEYKI PO NABLYUDENIYAM C ISKUSSTVENNYKH SPUTNIKOV ZEMLI]

N. F. Veltishchev et al Washington NASA Nov. 1970 13 p refs Transl. into ENGLISH from Tr. Gibrometeorol. Nauchn.-Issled. Tsentr. SSSR (Leningrad), no. 20, 1968 p 22-29
(Contract NASw-2035)
(NASA-TT-F-13363) Avail: NTIS CSCL 04B

A series of photographs showing convective cloud cells, taken by the Cosmos-122 satellite, are analyzed. Data from a statistical analysis of the results of measurements of the horizontal dimensions of cloud cells with descending movements at the center are presented. The effect of moisture on the structure of convective cells, and characteristic values for the wind speed at ground level in synoptic situations favorable to the development of symmetric convective cells are given. It is concluded that television pictures of symmetric convective cells can be used to estimate the thickness of the convective layer, the vertical temperature gradient and the humidity of the air in this layer. Author

N71-11469# Freie Univ., Berlin (West Germany). Inst. for Meteorology and Geophysics.

METEOROLOGICAL DATA. VOLUME 98, NO. 1: WEATHER SATELLITE OBSERVATIONS AND THEIR EVALUATION. THE EUROPEAN CLIMATOLOGY, 1968, PART 1 Quarterly Report [METEOROLOGISCHE ABHANDLUNGEN. BAND XCVIII, HEFT 1: WETTERSATELLITENBEOBACHTUNGEN UND IHRE AUSWERTUNG. DAS EUROPAEISCHE WETTERBILD 1968. TEIL I, 1. VIERTELJAHR]

Ingrid Haupt, Uta Kontergiannakis et al 1969 147 p In GERMAN
(QR-1-Pt-1) Avail: NTIS

This volume 98 in continuation of volume 84 (1967) and volume 70 (1966) is the third one with weather-satellite observations gained in Berlin. It presents in No. 1-4 the collected European climate of 1968. Part 1 gives a short review of the first decade of space research in USA. A new Soviet weather-satellite "Cosmos 206" is described, and some remarks on the snow- and ice-situation in the European area with exception of the Arctic regions are included. Author

N71-11568# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

ESTIMATION OF SOME COMPONENTS OF THE TURBULENT ENERGY BALANCE

P. A. Vorontsov 19 Jun. 1970 10 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 185, 1966 p 72-76
(Contract NOw-62-0604-c)
(AD-711947; APL-CLB-3-T-622) Avail: NTIS CSCL 4/1

The report discusses some problems in calculating the kinetic energy of turbulence from balloon sounding data for the region of the Shchekino thermal power station. Author (TAB)

N71-11601*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

APPLICATIONS TECHNOLOGY SATELLITE METEOROLOGICAL DATA CATALOG, VOLUME 1, 1 JANUARY-30 JUNE 1967

Oct. 1967 468 p Prepared by Allied Res. Assoc., Inc.
(Contract NAS5-10343)
(NASA-TM-X-66466) Avail: NTIS CSCL 04B

Photographic and tape meteorological data acquired from the ATS-1 satellite are presented. The data catalog includes: (1) the type of data available; (2) a meteorological data log identifying pictures as to time and picture quality; (3) orbital data; and (4) a daily example of the photographic data acquired. A separate section contains the ATS-1 spin scan cloud camera data user's guide which describes the ATS-1 system and offers an explanation of the data acquisition, categorization, cataloging and archiving processes. A computerized data service, based on the categorization scheme is also described. D.L.G.

N71-11602*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

APPLICATIONS TECHNOLOGY SATELLITES METEOROLOGICAL DATA GUIDE

[1969] 358 p Prepared by Allied Res. Assoc., Inc.
(Contract NAS5-10343)
(NASA-TM-X-66467) Avail: NTIS CSCL 04B

The ATS-3 system is discussed including the spacecraft, experiments, spacecraft orbit, spacecraft attitude effects, and data acquisition. Descriptions of the multicolor spin scan cloud camera system and the image dissector camera system are given covering the cameras, their operation, meteorological data acquisition, magnetic tape recording, data documentation and processing, time determination, and attitude effects. Meteorological data catalogs for the ATS-3 and ATS-1 satellites are summarized including orbital data and MSSCC, SSCC, and IDCS tape listings. The ATS-2 is also mentioned. J.M.

N71-11603*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

APPLICATIONS TECHNOLOGY SATELLITES METEOROLOGICAL DATA CATALOG, VOLUME 3, 1 FEBRUARY-31 DECEMBER 1968

Mar. 1969 601 p Prepared by Allied Res. Assoc., Inc.
(Contract NAS5-10343)
(NASA-TM-X-66468) Avail: NTIS HC $10.00/MF $0.65 CSCL 04B

The third volume, in a series of catalogs published to document the meteorological data acquired from the Applications Technology Satellites is presented. Part 1, of the catalog documents data from ATS-1 stationed over or near 151 deg W longitude; Part 2, documents data from ATS-3 stationed at a number of positions between 95.1 deg W longitude and 44.5 deg W longitude. Comments on satellite operation, meteorological data acquisition, and documentation and archival are provided, also a list of the orbital elements. The meteorological data acquired and comments on photographic quality and meteorological and geomorphological content are tabulated, and examples of the cloud photographs are included opposite the daily data listing. In addition, analog and/or digital tapes which are on file are reported. Author

N71-11604*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

APPLICATIONS TECHNOLOGY SATELLITES METEOROLOGICAL DATA CATALOG, VOLUME 4, 1 JANUARY-31 JULY 1969

Dec. 1969 588 p Prepared by Allied Res. Assoc., Inc.
(Contract NAS5-10343)
(NASA-TM-X-66469) Avail: NTIS HC $10.00/MF $0.65 CSCL 04B

Data acquired from ATS-1 and ATS-3 are given. The material is presented in four sections that include: (1) comments on satellite operation, data acquisition, documentation, and archiving; (2) lists of the orbital elements; (3) tabulations of the meteorological data, comments on photographic quality, and examples of the photographs; and (4) a listing of the analog and/or digital tapes which are on file. D.L.G.

N71-11613*# Wisconsin Univ., Madison. Space Science and Engineering Center.

METEOROLOGICAL MEASUREMENTS FROM SATELLITE PLATFORMS Annual Scientific Report, 1968-1969

Verner E. Suomi and Thomas H. Vonder Haar Aug. 1970 383 p refs

(Contract NAS5-11542)
(NASA-CR-111369) Avail: NTIS CSCL 04B

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6. POSSIBILITIES FOR QUANTITATIVE RADIANCE MEASUREMENTS IN THE 450-650 nm REGION FROM THE ATS-1 SATELLITE S. K. Peekna, R. J. Parent, and T. H. Vonder Haar p 201–217 refs (See N71-11619 02-20)

7. A STUDY OF CLOUD DISTRIBUTIONS USING REFLECTED RADIANCE MEASUREMENTS FROM THE ATS SATELLITES A. J. Stamm and T. H. Vonder Haar p 219–238 refs (See N71-11620 02-20)

8. SATELLITE MEASUREMENTS OF THE EARTH'S RADIATION BUDGET DURING A FIVE-YEAR PERIOD T. H. Vonder Haar p 239–254 refs (See N71-11621 02-20)

9. A STUDY OF THE INDIAN MONSOON USING SATELLITE MEASURED ALBEDO AND LONG WAVE RADIATION p 255–281 refs (See N71-11622 02-20)

10. SIMULATION AND ANALYSIS OF MICROWAVE PROPAGATION BETWEEN OCCULATION SATELLITES D. H. Sargeant p 283–345 refs (See N71-11623 02-20)

11. BALLOON-BORNE RADIO ALTIMETER N. Levanon p 349–377 refs (See N71-11624 02-14)

12. WOBBLE-SPIN TECHNIQUE FOR SPACECRAFT INVERSION AND EARTH PHOTOGRAPHY N. H. Beachley and J. J. Uicker, Jr. p 379–388 ref (See N71-11625 02-21)

N71-11614*# Wisconsin Univ., Madison. Space Science and Engineering Center.

GEOSYNCHRONOUS METEOROLOGICAL SATELLITE

Verner E. Suomi and Thomas H. Vonder Haar *In its* Meteorol. Meas. from Satellite Platforms Aug. 1970 p 1–7 ref Presented at AIAA 5th Ann. Meeting and Tech. Display, Philadelphia, 21-24 Oct. 1968 Revised *Its* Paper 68-1094 (See N71-11613 02-20)
Avail: NTIS CSCL 22B

The processes involved in taking cloud photographs from ATS 1 and ATS 3, and the quality of the photographs are described. The meteorological applications in general, and those for severe weather watch and quantitative measurements in particular, are discussed. It is felt that the advantages of the spin scan cloud camera are no optics distortion, equal sensitivity everywhere, wide dynamic range, and contrast limited by scatter in the optics only. N.E.N.

N71-11615*# Wisconsin Univ., Madison.

APPLICATIONS FOR BISPECTRAL RADIANCE MEASUREMENT FROM A SATELLITE

Kirby J. Hanson *In its* Meteorol. Meas. from Satellite Platforms Aug. 1970 p 9–75 refs (See N71-11613 02-20)
Avail: NTIS CSCL 04B

The use of Rayleigh scattering as a measure of atmospheric parameters from a geostationary satellite is discussed. Two cases are considered: one for clouds with high reflectance, and the other for the ocean surface with low reflectance. Cloud top height and total mass above the sea level surface, or sea level pressure, are determined. It is emphasized that the model did not account for particulates. It is shown that with typical instrument performance parameters, the altitude could be determined to 200 ft and sea level pressure to less than 2 mb, providing a large number of measurements were used. It is essential, in surface pressure determination, that no clouds are in the optical path. Means to optimize the instrument performance parameters are included. Author

N71-11616*# Wisconsin Univ., Madison.

CONVECTIVE HEAT TRANSPORT OVER THE TROPICAL MID-PACIFIC AS ESTIMATED FROM A GEOSYNCHRONOUS SATELLITE ALTITUDE

Dhirendra Nath Sikdar *In its* Meteorol. Meas. from Satellite Platforms Aug. 1970 p 77–160 refs (See N71-11613 02-20)
(Grant CWB-WBG-27)
Avail: NTIS CSCL 04B

An objective technique is developed to estimate the mass and energy exchange in a convection system corresponding to congestus and cumulonimbus intensities. The technique involves measuring the area change of the cirrus outflow on a sequence of satellite cloud photographs. The data show that the technique is able to isolate vigorous and moderate convection regimes on the ATS 1 and ATS 3 satellite photographs, and values of mass and energy flux are consistent with ground based measurements. The technique is then applied to a large scale convective mass and energy exchange over the tropical mid-Pacific. The results show that the releases of convection on a mesosynoptic to subsynoptic scale are controlled by the large scale motion field and that the convective heat transport pulsates with an approximate periodicity of five days. In the short range time scale (minutes to one day) on some days intense variations in the daytime convective activities are observed, but these variations seem to have no relation with the diurnal heating cycle. Convective activity occurrence is random in character in the short range time scale but is well organized on a time scale of a few days to a month. Author

N71-11617*# Wisconsin Univ., Madison.

A CENSUS OF CLOUD SYSTEMS IN THE TROPICAL PACIFIC OCEAN

Otto J. Karst *In its* Meteorol. Meas. from Satellite Platforms Aug. 1970 p 161–185 refs (See N71-11613 02-20)
Avail: NTIS CSCL 04B

As a supporting study to a GARP tropical meteorology experiment a census was made on cloud systems using ATS 1 and ESSA 3 satellite photographs. Organized cloud systems were classified by geometric patterns into an oval, line, wave, or spiral vortex. There are large differences between the northern and southern hemisphere in the level of organization and the frequency of cloud systems. The northcentral Pacific region has a lower level of organization than the two other regions in the northern hemisphere. The study shows that there are high frequencies of waves and vortices for the northeast and northwest tropical Pacific regions during the summer and early fall months. In terms of the frequency of organized cloud systems the northeast region and the northwest region would seem to be about equally suitable for a prospective tropical field experiment. Author

N71-11618*# Wisconsin Univ., Madison.

A CENSUS OF SYNOPTIC SCALE DISTURBANCES OVER THE CENTRAL AND EASTERN PACIFIC DURING MARCH 1967–FEBRUARY 1968

A. Staver, Thomas H. Vonder Haar, R. Cram, and R. DeDecker *In its* Meteorol. Meas. from Satellite Platforms Aug. 1970 p 187–200 refs (See N71-11613 02-20)
Avail: NTIS CSCL 04B

Results of cloud census taking obtained by two people independently reading the same data are presented and compared. Data are given for the tropics and subtropics, and the interchange between hemispheres and between the tropics and subtropics are described. The best regions and seasons for studying different types of weather are indicated. It is felt that census taking leads to a certain amount of ambiguity when different individuals interpret the same satellite cloud photographs, caused mostly by disorganized cloud clusters. N.E.N.

N71-11619*# Wisconsin Univ., Madison.

POSSIBILITIES FOR QUANTITATIVE RADIANCE MEASUREMENTS IN THE 450-650 nm REGION FROM THE ATS-1 SATELLITE

Susan K. Peekna, Robert J. Parent, and Thomas H. Vonder Haar *In its* Meteorol. Meas. from Satellite Platforms Aug. 1970 p 201–217 refs (See N71-11613 02-20)
Avail: NTIS CSCL 04B

Equations that could be used in the prelaunch calibration of satellite cameras such as that flown on the ATS 1 are developed. Information about applying ATS 1 data is presented, and the procedure for obtaining absolute values of reflected spectral radiance is discussed. The steps required to convert digital count values to the effective radiance of the source as viewed by the camera are described. It is concluded that measurements of the spectral radiance from an area of source radiation can be derived from the ATS 1 observations, and the relationship between these reflected radiance value and the camera voltage output or digital counts is shown. The digitized ATS data must be considered in terms of the following: the camera measures only the effective radiance between 450 and 650 nanometers; the camera has a nonuniform response across its nominal field of view; and the relation between the digital count values and the camera output voltage depends on two gain settings. N.E.N.

N71-11620*# Wisconsin Univ., Madison.

A STUDY OF CLOUD DISTRIBUTIONS USING REFLECTED RADIANCE MEASUREMENTS FROM THE ATS SATELLITES

Alfred J. Stamm and Thomas H. Vonder Haar *In its* Meteorol. Meas. from Satellite Platforms Aug. 1970 p 219–238 refs (See N71-11613 02-20)
Avail: NTIS CSCL 04B

Reflected radiance measurements from the multicolor spin-scan cloud camera on ATS 3 are used to determine the percentages of selected areas of the earth that are cloudfree. The areas chosen are meteorologically active and represent common cloud patterns. Use of several data unit sizes shows how the observed percent clear area decreases with decreasing saptial resolution of a simulated sensor. Methods of determining a cloud-no cloud threshold are discussed. The change of cloud cover over a period of a few hours is examined. It is found that clouds smaller than the instantaneous field of view are often not recognized as clouds and therefore tend to affect the interpretation of spacecraft camera measurements. The results of this investigation are used to suggest the optimum spatial resolution for radiometrically sounding the atmosphere from a geosynchronous satellite. Author

N71-11621*# Wisconsin Univ., Madison.

SATELLITE MEASUREMENTS OF THE EARTH'S RADIATION BUDGET DURING A FIVE-YEAR PERIOD

Thomas H. Vonder Haar *In its* Meteorol. Meas., from Satellite Platforms Aug. 1970 p 239–254 refs (See N71-11613 02-20) Presented at Symp. on the Future of the Atmosphere, Madison, Wisc., Oct. 1969; presented at AMS/RMS Conf. on the Global Circulation of the Atmosphere, London, Aug. 1969
Avail: NTIS CSCL 04B

An extended time series of measurements of the earth's radiation budget from the first and second generation United States meteorological satellites is summarized. Values of planetary albedo, infrared radiant emittance and the resulting net radiation budget are now available for more than 15 months during the period 1962 to 1966. These measurements show a mean global albedo of 30%, and net radiation balance within measurement accuracy. The discussion treats global and zonally averaged values for the mean annual case and for mean seasons, and includes a comparison of measurements during the same seasons in different years. The role of these radiation budget measurements in the total global energy balance is noted. Author

N71-11622*# Wisconsin Univ., Madison.

A STUDY OF THE INDIAN MONSOON USING SATELLITE MEASURED ALBEDO AND LONG WAVE RADIATION

Gerald J. Dittberner *In its* Meteorol. Meas. from Satellite Platforms Aug. 1970 p 255–281 refs (See N71-11613 02-20)
Avail: NTIS CSCL 04B

Thirty months of continuous low resolution satellite data, emitted long wave radiation, and albedo are used to study the Indian monsoon. These data, combined with rainfall data for the Indian subcontinent, are employed to develop an intensity index which provides the first quantitative measure of monsoon intensity. Three monsoons are studied: the 1963 monsoon, the strong 1964 monsoon, and the very weak 1965 monsoon. Intensity differences show up most dramatically on the intensity index maps. The time history of the 1964 and 1965 monsoons are examined showing how the intense cloudiness of the 1964 monsoon lingered on for a number of months apparently reducing surface heating significantly preceding the weak 1965 monsoon. Typical values of the intensity index, long wave radiation, and albedo are compiled for each season of the year preceding the 1964 and 1965 monsoons. Finally, the monsoon is described in terms of radiation depicting certain recurring, quasi-steady state, and seasonal features. Author

N71-11623*# Wisconsin Univ., Madison.

SIMULATION AND ANALYSIS OF MICROWAVE PROPAGATION BETWEEN OCCULTATION SATELLITES

Douglas H. Sargeant *In its* Meteorol. Meas. from Satellite Platforms Aug. 1970 p 283–345 refs (See N71-11613 02-20) (Grant NSF GA-1167)
Avail: NTIS CSCL 04B

The results of studies designed to evaluate the feasibility of remotely probing the earth's atmosphere by measuring the refraction of microwaves propagated between occultation satellites are presented. Several methods are developed for accurate calculation of refraction variables, and techniques for the representation of vertical refractivity profiles are explored. The results are applied to the simulation of microwave refraction for a number of atmospheric conditions, both modeled and real. Finally, the inversion of microwave occultation measurements to obtain useful meteorological data is discussed. Author

N71-11661 National Lending Library for Science and Technology, Boston Spa (England).

QUANTITATIVE ESTIMATE OF MICROCLIMATIC VARIABILITY OF CALCULATED WINTER TEMPERATURES OF THE OUTSIDE AIR FOR BUILDING PURPOSES

Z. A. Miscenko 8 Apr. 1970 14 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 248, 1969 p 87–96 (NLL-M-9142-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The geographical distribution of the mean of the absolute annual temperature minima theta M for the USSR was studied for application to heat engineering calculations in construction of industrial buildings and living quarters. Division of the microclimatic variability of theta M into regions for hilly and mountain relief was based on quantitative allowance for the ruggedness of the relief. Seven regions with a different microclimatic variability are distinguished according to the relief. Analysis of data from more than 300 meteorological stations for theta M, the temperature of the coldest 5-day period in the year, the winter ventilation temperature, and the temperature of the coldest month shows that these thermal characteristics are mutually connected, and that if the geographical variability of one of them is known, the others can be estimated. Author

N71-11665# Washington Univ., Seattle. Dept. of Atmospheric Sciences.
CONTRIBUTIONS FROM THE CLOUD PHYSICS LABORATORY: RESULTS OF AIRCRAFT MEASUREMENTS IN WINTER STORMS (1968–1969) OVER THE CASCADE MOUNTAINS
P. V. Hobbs, B. F. Ryan, W. H. Mach, and D. A. Wilson Sep. 1969 111 p refs
(Contract DI-14-06-D-5970; Grant NSF GA-780)
(PB-193441; RR-3) Avail: NTIS CSCL 04B

The cloud physics group at the University of Washington is engaged in a research program to determine the principal mechanism by which precipitation develops in the winter storms over the Cascade Mountains of the Pacific Northwest, and to investigate both theoretically and experimentally the feasibility of diverting some of the winter snowfall from the western to the eastern slopes of the Cascade Mountains by artificial seeding. At the present time the program involves three main areas of investigation: the development of a theoretical model to describe the airflow over the Cascade Mountains and the growth and fallout of precipitation in the winter storms, ground observations during winter storms (radar, radiosondes, distribution and types of precipitation), and incloud airborne measurements (cloud particles, ice nuclei, liquid-water content, temperature, etc.) in winter storms. Author (USGRDR)

N71-11666# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
MESOPHERIC WINDS OVER ASCENSION ISLAND IN JANUARY
B. T. Miers and J. E. Morris Jul. 1970 24 p refs
(AD-711851; ECOM-5312) Avail: NTIS CSCL 4/2

Mesospheric wind data taken over Ascension Island (7 deg 59 min S, 14 deg 25 min W) in January and February 1970 are discussed. A January mesospheric-stratospheric circulation model was constructed using these and other winds to show that winter westerly winds extend into the summer hemisphere to about 15S at mesospheric levels, while summer easterlies extend into the winter hemisphere to about 20N at stratosphere levels. A strong southwest flow at 75 km indicated a cross-equatorial flow in the region of Ascension Island. Author (TAB)

N71-11667# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
GUST FACTOR VARIATIONS WITH HEIGHT AND ATMOSPHERIC STABILITY
H. H. Monahan and M. Armendariz Aug. 1970 40 p refs
(AD-711855; ECOM-5320) Avail: NTIS CSCL 4/2

Data collected from wind instrumentation installed on a 152.4 meter meteorological tower located on White Sands Missile Range, New Mexico, are analyzed to determine gustiness characteristics during both unstable and very stable regimes. The following results are indicated: an increase in gust factors occurs as the air mass instability becomes greater and as the mean wind speed time averaging period is enlarged; however, a decrease in gust factors is associated with increases in height and wind speed and as the peak wind speed averaging interval is extended. Also, estimates of gust factors to a height of 152.4 meters are obtained for different averaging times and stability conditions by introducing a known gust factor value at 15.3 meters and a computed constant into a simple power-law expression. Author (TAB)

N71-11672# Centre National d'Etudes Spatiales, Toulouse (France). Div. 'Systemes et Projets Ballons.'
THE EOLE PROJECT [LE PROJET EOLE]
J. Muller Paris 1970 10 p In FRENCH Presented at the Space Symp., Rennes, France, 16–19 Jun. 1970; sponsored jointly by CNES, Centre de Perfectionnement Tech., and Fac. des Sci. de Rennes
Avail: NTIS

The aims of the project as well as means to be used for studying the atmospheric circulation are described. This includes to some extent the data processing procedure. ESRO

N71-11673 World Meteorological Organization, Geneva (Switzerland). Joint Organizing Committee for GARP.
PROBLEMS OF ATMOSPHERIC RADIATION IN GARP
F. Moeller and C. D. Rodgers Jul. 1970 31 p refs *Its* GARP Publ. No. 5
Copyright. Avail: WMO, Geneva

The importance of radiation for short-range, medium-range, and long-range climatological investigations is discussed. An indication is given of the radiation quantities which should be measured during the first GARP (Global Atmospheric Research Program) global experiment, and the investigations to be carried out before completion of this experiment. ESRO

N71-11674# Washington Univ., Seattle. Dept. of Atmospheric Sciences.
CONTRIBUTIONS FROM THE CLOUD PHYSICS GROUP: USE OF RADAR IN THE STUDY OF WINTER STORMS OVER THE CASCADE MOUNTAINS
Dean A. Wilson and Peter V. Hobbs Dec. 1969 41 p refs
(Contract DI-14-06-D-5970)
(PB-193442; RR-4) Avail: NTIS CSCL 04B

Radar, and other observations, have shown that wintertime Pacific cyclonic storms do not, in general, consist of large areas with horizontally uniform precipitation rates but contain bands or cells of heavier precipitation. These cells or bands tend to be oriented in a spiral fashion out of the storm center. It takes on the order of 1-2 hours for such a band to pass over a local area. The use of both conventional and Doppler radars to study the flow of air and the trajectories of precipitation particles over the Cascade Mountains during the passage of a wintertime cyclonic storm are considered. Author (USGRDR)

N71-11676*# Scientific Translation Service, Santa Barbara, Calif.
ANALYSIS OF MEASUREMENTS OF WIDE-SECTOR INSTRUMENTS ABOARD THE COSMOS-122 SATELLITE [ANALIZ IZMERENIY SHIROKOSEKTORNYKH PRIBOROV SPUTNIKA KOSMOS-122]
S. A. Bystramovich et al Washington NASA Nov. 1970 10 p refs Transl. into ENGLISH from Tr. Gidrometeorologicheskgo Nauchn.- Issled. Tsentra SSR (Leningrad), no. 20, 1968 p 42–49
(Contract NASw-2035)
(NASA-TT-F-13366) Avail: NTIS CSCL 04B

A survey and qualitative comparison are presented of the measurements of wide-sector instruments with the results of interpretation of television and infrared pictures taken by the "Cosmos-122" satellite as well as with the data of observations made by a network of ground meteorological stations. The curves are given for the distribution of the effective radiation temperature and the shortwave radiation energy along orbits passing over Africa, the territory of the USSR and Pacific Ocean. The agreement of the paths of these curves for orbits passing over Africa is examined. A comparison is made of the paths of these curves with the intensity distribution of the cloud cover obtained on the basis of data from nephanalysis. Author

N71-11677# Weather Wing (1st) San Francisco, Calif.
AUGUST CLIMATE OF SOUTHEAST ASIA Final Climatological Study
Jun. 1970 71 p refs Revised
(AD-711386; WWSS-105-11/8-Rev) Avail: NTIS CSCL 4/2

The report deals with the climate of North Vietnam, Republic of Vietnam, Laos, Cambodia, and Thailand for August. Essentially based on previously available data, however, precipitation analyses, ceiling/visibility, and upper air flow are new. The report contains brief notes on the climate of Southeast Asia and the geographical features of the Republic of Vietnam, North Vietnam, Cambodia, Laos, and Thailand. The report discusses the precipitation, thunderstorms, cloudiness, visibility and obstructions to vision, combined ceiling/visibility, temperature, relative humidity, surface and upper winds, miscellaneous phenomena and sea operations. The report contains a station locator and topography map. Isoline analyses (map scale 1:9,000,000) are given for precipitation days, mean, maximum, and minimum precipitation, days with thunderstorms, mean cloudiness, percent frequency of ceiling/visibility = or > 5000/5 and = or > 1000/2 1/2 (7 + 16 LST), daily max and min temperatures and mean relative humidity. For selected stations tabular data on fog days, percent frequency visibility 1 mile and 5 miles (7 + 16 LST) are given also. Mean streamline charts (1:37,500,000) are given for 2000 ft, 850mb, 700mb, 500mb, 300mb, and 200mb levels. Also included are charts of mean position of polar front and ICZ (1:17,000,000) typhoon tracks. Author (TAB)

N71-11678# Weapons Research Establishment, Salisbury (Australia).
DROPSONDE TEMPERATURE AND PRESSURE RESULTS, WOOMERA, SOUTH AUSTRALIA, 1968 AND 1969
A. D. Hind Jun. 1970 37 p refs
(WRE-TN-HSA-170) Avail: NTIS

The W.R.E. Dropsonde is defined as an expendable instrumented package released from a low cost rocket to obtain vertical profiles of temperature, pressure, and winds in the upper atmosphere. The pressure and temperature results obtained during 1968 and 1969 are presented. Author

N71-11679 World Meteorological Organization, Geneva (Switzerland). Joint Organizing Committee for GARP.
REPORT OF INTERIM PLANNING GROUP ON GARP TROPICAL EXPERIMENT IN THE ATLANTIC
Aug. 1970 34 p Conf. held at London, 22–24 Jul. 1970 *Its* GARP Spec. Rept. No. 2
Copyright. Avail: WMO, Geneva: Sw.Fr. 5

The objectives of the tropical experiment are: (a) to examine the interactions between the large wave scale (scale A: 2 to 10,000 km) and the scale of cloud clusters (scale B: 100 to 1000 km), (b) to examine the interactions between scale B and the mesoconvective scale (scale C: 10 to 100 km) including the collective effect of the scale of convection cells (scale D: 1 to 10 km). A report is given on discussions and plans for implication of these objectives. ESRO

N71-11687# Institut Royal Meteorologique de Belgique, Brussels.
CLIMATOLOGICAL OBSERVATIONS Monthly Bulletin, Aug. 1970 [OBSERVATIONS CLIMATOLOGIQUES Bulletin Mensuel, Aout 1970]
1970 17 p In FRENCH and DUTCH
Avail: NTIS

Climatological data derived from observations made at different Belgian weather stations during August 1970 are given. ESRO

N71-11688 National Lending Library for Science and Technology, Boston Spa (England).
AN ANALYSIS OF METEOROLOGICAL CONDITIONS FOR HAZARDOUS AIR POLLUTION IN TOWNS
L. R. Sonkin 29 May 1970 13 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 234, 1968 p 60–68
(NLL-M-9128-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Eng.: 2 NLL photocopy coupons

The relationship between synoptic weather types and air pollution is studied for several towns for which relatively complete data on air pollution are available. The weather types are the following: Type A, pressure field without pressure gradient; Type I, intermediate field with directed pressure gradient; and Type D, depression with cloudy weather, strong winds, and precipitation. It was determined that instances of high pollution were associated with Type A weather. N.E.N.

N71-11690# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
STRONG SURFACE WIND GUSTS AT HOLLOMAN AFB (MARCH–MAY)
Thomas H. Pries Fort Monmouth, N.J. ECOM Jul. 1970 26 p refs
(AD-711853; ECOM-5315) Avail: NTIS CSCL 4/2

A climatological study was made of strong surface winds at Holloman AFB, New Mexico, for the months of March through May. Winds were categorized as 25-34 knots, 35-49 knots, and 50 knots or more. The frequency of strong winds was analyzed in terms of direction, station pressure, and time of day for all three categories. Author (TAB)

N71-11691# Institut Royal Meteorologique de Belgique, Brussels.
CLIMATOLOGICAL OBSERVATIONS Monthly Bulletin, May 1970 [OBSERVATIONS CLIMATOLOGIQUES Bulletin Mensuel, May 1970]
1970 16 p In ENGLISH and FRENCH
Avail: NTIS

Climatological data derived from observations made at different Belgian weather stations during May 1970 are given. ESRO

N71-11692# Royal Aircraft Establishment, Farnborough (England).
A NEW SYSTEM FOR THE AUTOMATIC MEASUREMENT AND RECORDING OF RAINFALL
C. F. Lucas Mar. 1970 22 p ref
(RAE-TR-70051) Copyright. Avail: NTIS

A new system for the automatic measurement and recording of rainfall is described. It can be left unattended for periods of up to three months in remote areas and is capable of either storing or transmitting the acquired information. The rain gage, which has a peristaltic pump, is designed to run on 12 volt dry cell batteries with a variable resistance level detector circuit. Author (ESRO)

N71-11693# Institut Royal Meteorologique de Belgique, Brussels. Regie des Voies Aeriennes et Force Aerienne.
SYNOPTIC OBSERVATIONS Monthly Bulletin, Jul. 1969 [OBSERVATIONS SYNOPTIQUES Bulletin Mensuel, Juillet 1969]
1970 32 p In FRENCH and DUTCH
Avail: NTIS

Synoptic measurements made at different Belgian weather stations in July 1969 are presented. ESRO

N71-11694# Institut Royal Meteorologique de Belgique, Brussels. Regie des Voies Aeriennes et Force Aerienne.
SYNOPTIC OBSERVATIONS Monthly Bulletin, Aug. 1969 [OBSERVATIONS SYNOPTIQUES Bulletin Mensuel, Aout 1969]
1970 32 p In FRENCH and DUTCH
Avail: NTIS

Synoptic measurements made at different Belgian weather stations in August 1969 are presented. ESRO

N71-11741# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
NUMERICAL INTERPRETATION OF THE WIND, TEMPERATURE AND SPECIFIC HUMIDITY PROFILES FOR THE SURFACE BOUNDARY LAYER OF THE ATMOSPHERE
Frank V. Hansen and Juana Serna Jun. 1970 182 p refs
(AD-711939; ECOM-5307) Avail: NTIS CSCL 4/2

The dynamic similarity hypothesis for the shape of the wind, temperature, and specific humidity profiles is discussed for stationary, homogeneous conditions. The similarity arguments are presented a priori in terms of the semi-empirical diabatic influence functions which are numerically integrated to provide these and the related universal functions used as profile correction factors. The results of the numerical interpretation are given in tabular and graphical format. Author (TAB)

N71-11754 National Lending Library for Science and Technology, Boston Spa (England).

ON THE STRUCTURE OF INVERSION LAYERS

G. B. Maskova 8 Apr. 1970 8 p refs Transl. into ENGLISH from Tr. Gl. Upr. Gidrometeorol. Sluz., Inst. Prik. Geofiz. (Moscow), no. 10, 1967 p 44–51
(NLL-M-9143-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Surface and elevated inversions, observed at various times of the year and in various weather conditions, are considered in detail. The measurements were made on a 300-meter mast and permit solution of problems involving diffusion of noxious impurities, forecasting of low clouds, fog, glazed frost, rime etc. The results show that wind speeds in an elevated inversion are usually greater than those at the surface. The wind speed maximum often accompanies the base of the inversion, but can be observed inside the inversion layer. There is little change in wind direction either below the inversion layer or at its base. All the observed inversions began to form 2 to 3 hours before sunset and to collapse 40 to 50 minutes after sunrise on clear nights, and 1.5 to 2 hours after sunrise on cloudy nights. The inversions in clear weather collapse within 1 to 2 hours from both above and below. On cloudy days an elevated inversion lasts much longer, sometimes collapsing only when there are breaks in the cloud. R.B.

N71-11769# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.

TURBULENCE DATA DERIVED FROM MEASUREMENTS ON THE 32 METER TOWER FACILITY, WHITE SANDS MISSILE RANGE, NEW MEXICO

Gaylon S. Campbell, Frank V. Hansen, and Raymond A. Dise Jul. 1970 90 p refs
(AD-711852; ECOM-5314) Avail: NTIS CSCL 4/2

Bivane wind measurements and fast-response thermocouple temperature measurements made at heights of 2, 4, 8, 16, and 32 meters over a nonuniform desert surface at White Sands Missile Range, New Mexico, were used as the basis for calculating turbulence parameters at those levels. The data were recorded at a rate of one scan per second and were processed in 30-minute blocks to yield mean wind velocity, mean temperature, standard deviations of the orthogonal wind components and temperature, heat, momentum, and kinetic energy fluxes, skewness, kurtosis, and the production and dissipation of turbulent energy in the boundary layer. About 30 hours of data were collected during the months of November, December, and January, were analyzed, and are presented in the report. Author (TAB)

N71-11796*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

ATMOSPHERIC ELECTRICITY CRITERIA GUIDELINES FOR USE IN SPACE VEHICLE DEVELOPMENT

Glenn E. Daniels 25 Aug. 1970 21 p refs
(NASA-TM-X-64549) Avail: NTIS CSCL 04B

The accidental triggering of lightning discharges by the Apollo 12 space vehicle shortly after launch initiated a detailed study of these discharges as they relate to space vehicle missions. From information resulting from conferences and discussions and from recent publications, the chapter entitled Atmospheric Electricity of the report Terrestrial Environment (Climatic) Criteria Guidelines for Use in Space Vehicle Development, 1969 revision (N70-16998), was revised and is presented. Thunderstorm electricity, static electricity, and electrical breakdown of the atmosphere are discussed. Author

N71-11797*# Lockheed Missile and Space Co., Huntsville, Ala.

A MAXOMETER FOR PEAK WIND SPEED ANEMOMETRY

Final Report, 26 Mar. 1969 – 26 May 1970

P. T. Johnson and M. C. Krause Jun. 1970 90 p refs
(Contract NAS8-24020)
(NASA-CR-61337; LMSC/HREC-D-162380-A) Avail: NTIS CSCL 04B

A maxometer concept which used a flat disk and two constant-rate springs (high and low) was designed and developed. The concept included a precision clutching mechanism to retain a given displacement of the springs when exposed to the dynamic pressure generated from a given maximum wind velocity. Two maxometer configurations were developed: Models S and E. The Model S configuration was a fixed-orientation model capable of exposure to, and measurement of, winds induced during a typical launch from the Saturn 5 launch umbilical tower. The Model E configuration was a weather-vaning model which was designed for the normal meteorological environment. The same measuring and recording technique was used in both models. Three Model S and three Model E maxometers were fabricated and tested. Three Model S and one Model E were tested in the 7 × 10-foot wind tunnel. Results of these tests indicate that the maxometer is capable of meeting the design specification, except for the low-range dynamic pressure values. Author

N71-11798 National Lending Library for Science and Technology, Boston Spa (England).

RESULTS OF MICROSURVEYS OF A NEW BUILT-UP AREA IN LENINGRAD

T. A. Golubova et al 9 Apr. 1970 10 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 248, 1969 p 57–62
(NLL-M-9144-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Microclimatic observations were taken in the summer of 1966 in a new building development in northern Leningrad. Measurements at a town building in the middle of a clover field were used as a control, and the other observation points were chosen to cover possible differences in temperature, humidity, and wind speed within the group of buildings. These points included sunny and shady sides of the buildings with and without vegetation, frontal and end gaps between houses, and points inside the courtyard. Among the findings are the following: the presence of vegetation increased the humidity, decreased the temperature and decreased wind speed; the air is warmer on the sunny side of the buildings than on the shady side; and the air temperature and humidity are more uniform on days with variable clouds. The turbulence characteristics of the wind are described. N.E.N.

N71-11847# American Meteorological Society, Boston, Mass.

BIBLIOGRAPHY ON HURRICANES AND SEVERE STORMS OF THE COASTAL PLAINS REGION

Washington Coastal Plains Center for Marine Develop. Serv. Oct. 1970 74 p refs Prepared for Coastal Plains Center for Marine Develop. Serv.
(Publ-70-2) Avail: Issuing Activity

The bibliography was produced for use by regional and urban planners, land developers, legislators, government administrators, scientists, engineers, and others concerned with the problems of occurrence of, protection against, and recovery from hurricanes and severe storms along the coastal plains. Scientific, technical, and nontechnical literature published during the period from 1945 to 1970 was used as a source. The bibliography is divided into sections on general literature for nontechnical readers, general and historical material for scientists and engineers, selected literature on the economic effects of hurricanes and storms, user instructions, abstracts of articles, a subject index, and an author index. R.S.

N71-12005*# Scientific Translation Service, Santa Barbara, Calif.

SMALL DISTURBANCES OF VERTICAL VELOCITY IN AN ASYMMETRIC ATMOSPHERIC VORTEX [MALYYE

VOZMUSACHENIYA VERTIKALNOY SKOROSTI V ASIMETRICHNOM ATMOSFERNOM VIKHRE]

N. F. Veltischev Washington NASA Nov. 1970 12 p refs Transl. into ENGLISH from Tr. Gidrometeorol. Nauchn.-Issled. Tsentra SSSR (Leningrad), no. 20, 1968 p 35–41
(Contract NASw-2035)
(NASA-TT-F-13365) Avail: NTIS CSCL 04B

The linear theory of disturbances of vertical velocity in an asymmetric vortex is developed. Asymmetry is considered to be a function of the rate of its shift. A closed system of equations of hydrothermodynamics leads to a conventional differential equation for vertical velocity which belongs to the class of degenerate hypergeometric equations. The boundary problem is solved (vertical movements at the center of a vortex are considered zero, and bounded at some finite r = a). Two illustrations are provided with the results of calculations of the vertical velocities at different rates of shift of the cyclone. The configuration of the zones of ascending and descending movements has a spiral appearance and corresponds qualitatively to the distribution of cloud cover in shifting cyclones, observed from artificial Earth satellites. Author

N71-12107# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.

NOCTURNAL MAXIMUM WINDS IN THE PLANETARY BOUNDARY LAYER AT WSMR

Laurence J. Rider and Manual Armendariz Aug. 1970 40 p refs
(AD-712325; ECOM-5321) Avail: NTIS CSCL 4/1

Ninety-one cases of nocturnal low-level maximum wind are examined in detail and are classified into three basic types based on the major forcing function responsible for development. The time of most frequent occurrence is discussed, some of the factors which are conducive to development are listed, a technique for computing the magnitude of the low-level maximum wind is given, and typical synoptic surface and 850 mb patterns associated with each of the three types of low-level maximum are presented. Author (TAB)

N71-12108# Edgerton, Germeshausen and Grier, Inc., Boulder, Colo. Environmental Services Operation.

A PARAMETERIZED NUMERICAL MODEL OF OROGRAPHIC PRECIPITATION

Paul T. Willis 28 Jan. 1970 95 p refs
(Contract DI-14-06-D-5640)
(PB-192757) Avail: NTIS CSCL 04B

The model described in the report calculates the steady state field of vertical velocity over an orographic barrier, the production of cloud water by this vertical velocity field, the conversion of this cloud water to hydrometer water, and the subsequent trajectory of this hydrometeor water to the surface. Author (USGRDR)

N71-12116# International Geophysical Year World Data Center A, Washington, D.C.

METEOROLOGY DATA REPORT: HIGH ALTITUDE METEOROLOGICAL DATA, VOLUME 6, NO. 3 MARCH 1969

Asheville, N.C. Natl. Climatic Center 1970 158 p
Avail: SOD $3.00

Wind and temperature measurements from all available meteorological sounding rocket firings are presented, along with computed values for pressure, density, and speed of sound. Local radiosonde observations nearest the time of firing are included. Author

N71-12124# Edgerton, Germeshausen and Grier, Inc., Boulder, Colo.

FIELD USE OF A SIMPLE TECHNIQUE FOR IDENTIFYING SILVER IODIDE PARTICLES AS SNOW CRYSTAL NUCLEI

Farn P. Parungo and J. Owen Rhea 1 Feb. 1970 20 p refs
(Contract DI-14-06-D-5640)
(PB-192754) Avail: NTIS CSCL 04B

A procedure is presented for identifying those silver iodide particles in ice crystals that have behaved as snow crystal nuclei. The new technique is based on the principle that any submicron particle can act as a nucleus in its own supersaturated solution, and can grow to any desired crystal size (the final size depending on time of exposure to the supersaturated solution). For the procedure presented, an aqueous solution of 30% potassium iodide (KI) supersaturated with silver iodide (AgI) is used. Application of the technique in a weather modification field research project is described. A case-study example is presented, and results of the season's experiments are discussed with emphasis on contributions of the nuclei identification data. It is concluded that the technique has considerable practical utility in qualitative determination of effects from cloud seeding. Author (USGRDR)

N71-12125# Edgerton, Germeshausen and Grier, Inc., Boulder, Colo. Environmental Services Operation.

A REVIEW OF RESULTS OF THE PARK RANGE WINTER OROGRAPHIC CLOUD SEEDING EXPERIMENT

J. Owen Rhea and L. G. Davis Feb. 1970 20 p refs
(Contract DI-14-06-D-5640)
(PB-192768) Avail: NTIS CSCL 04B

Statistical results of winter orographic cloud seeding in the Park Range Atmospheric Water Resources Project under a randomized seeding design are discussed. Data collected for statistical analysis included continuous records of precipitation rate, 15-minute snow samples, and Formvar snow crystal replicas. Operations were scheduled in six-hour blocks, and seeding was randomized into either the first or last three hours of each block. A numerical model was developed to simulate airflow, condensation, and precipitation over the Park Range barrier. The model output was used in combination with a model of atmospheric diffusion to obtain estimates of transport time of seeding material to various locations in the target area. This allowed data stratification into seeded and unseeded samples, using the randomized blocks lagged for transport time, and according to computed location of seeding effect. Author (USGRDR)

N71-12145 National Lending Library for Science and Technology, Boston Spa (England).

ON THE GENESIS OF THE 14-MONTH CYCLE IN THE EARTH'S ATMOSPHERE

N. A. Haminov 29 May 1970 6 p refs Transl. into ENGLISH from Izv. Vses. Geog. Obshch. (Moscow), no. 101, 1969 p 255–256
(NLL-M-9141-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The geophysical origin of the 14-month variation in the position of the earth's axis was demonstrated, and clear confirmation of the nutational origin of the 14-month atmospheric wave was investigated. This structure was studied by means of a complete Shuster periodogram analysis in the range 2 months to 11 years using monthly steps. Initial data included series of mean monthly magnetic disturbance indices, atmospheric pressures, atmospheric temperatures, and related data. It was concluded that the 14-month atmospheric cycles are not caused by the 14-month oscillations of the axis of rotation of the earth, but are the result of variations in the atmosphere of the length of the annual cycle of the geoactivity of the sun. E.M.C.

N71-12154# Joint Publications Research Service, Washington, D.C.

METEOROLOGY

In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 238 13 Oct. 1970 p 4–9 refs (See N71-12152 02-34)
Avail: NTIS

News briefs are presented for book reviews on theory of mesometeorological processes, climate modification, and solar-tropospheric relations, hail suppression measures in Yugoslavia, and abnormally warm temperatures recorded in stratosphere above the Antarctic. Abstracts are presented for shipborne radiometric measurements of thermal emission and humidity fluctuations over the Mediterranean Sea. R.B.

N71-12173# Oregon State Univ., Corvallis. Dept. of Oceanography.

ON THE DETERMINATION OF THE VERTICAL TRANSPORTS OF MOMENTUM AND HEAT IN THE ATMOSPHERIC BOUNDARY LAYER AT SEA [ZUR BESTIMMUNG DER VERTIKALEN TRANSPORTE VON IMPULS UND FUEHLBARER WAERME IN DER WASSERNAHEN LUFTSCHICHT UEBER]

Lutz Hasse Aug. 1970 63 p refs Transl. into ENGLISH from Hamburger Geophysikalische Einzelschriften (West Germany), v. 11, 1968 79 p
(Contract N00014-67-A-0369-0007)
(AD-711376; TR-188; Ref-70-22) Avail: NTIS CSCL 4/2

Direct measurements of the eddy fluxes of momentum and heat are obtained by hot wire anemometers at a buoy with servostabilized mast and at a tripod over water of 14 m depth in the Baltic Sea. Spectra of the vertical wind component are shown for different stabilities. The measured momentum fluxes may be summarized by a drag coefficient of K10 x 1000 = 1.2 plus or minus 0.24. This value agrees well with other observations. An increase of the drag coefficient with wind speed cannot be secured from the direct observations as they are not equally distributed over different stabilities. There is a tendency to smaller drag coefficients under stable and greater under unstable conditions. Additionally, usefulness of different methods for the determination of stress and sensible heat flux are described with emphasis on parameterization. Author (TAB)

N71-12181# National Environmental Satellite Center, Washington, D.C.

ARCHIVING AND CLIMATOLOGICAL APPLICATIONS OF METEOROLOGICAL SATELLITE DATA

John A. Leese, Arthur L. Booth, and Frederick A. Godshall Jul. 1970 133 p refs Presented at 5th Session of the WMO Comm. for Climatol., Geneva, 20–31 Oct. 1969
(ESSA-TR-NESC-53) Avail: SOD $1.25; NTIS

A working paper is presented for the fifth session of the WMO Commission for Climatology, describes the meteorological satellite program of the United States, the data acquired, the applications of the data to climatology, the procedures for archiving the data, and plans for future meteorological satellites. Author

N71-12182# National Environmental Satellite Center, Washington, D.C.

SATELLITE AND SENSORS FLOWN IN ORBIT, APPENDIX A

In its Archiving and Climatological Appl. of Meteorol. Satellite Data Jul. 1970 16 p (See N71-12181 02-20)
Avail: SOD $1.25; NTIS

The meteorological satellites launched to date are described. Pertinent factors which determine the type of data acquired from each are given. These include the satellite orbits and the types of sensors used. A significant number of the satellites launched to date were research and development (R&D) rather than operational. The ESSA satellites used in the TIROS Operational Satellite (TOS) system are the only satellites classed as operational. The potential users of meteorological satellite observations for climatological applications need to understand how the data were acquired to assure compatibility with the objectives of their analysis. Pertinent information in sufficient detail to permit the development of borad-scale plans for application of the data to climatology is provided. Author

N71-12183# National Environmental Satellite Center, Washington, D.C.

COMPUTER PROCESSING OF SATELLITE CLOUD PICTURES, APPENDIX B

In its Archiving and Climatological Appl. of Meteorol. Satellite Data Jul. 1970 7 p (See N71-12181 02-20)
Avail: SOD $1.25; NTIS

The current data processing procedures of the National Environmental Satellite Center are described. The procedures described include: (1) input data processing, (2) earth location, (3) picture gridding, and (4) picture mapping. F.O.S.

N71-12184# National Environmental Satellite Center, Washington, D.C.

CURRENT OPERATIONAL PRODUCTS FROM THE NATIONAL ENVIRONMENTAL SATELLITE CENTER, APPENDIX C

In its Archiving and Climatological Appl. of Meteorol. Satellite Data Jul. 1970 5 p (See N71-12181 02-20)
Avail: SOD $1.25; NTIS

The computer-derived products from the National Environmental Satellite Center are listed. Included are: (1) high resolution mapped video photoprints, (2) weather facsimile mapped video segments, (3) averages and composites, (4) semi-automated products, and (5) manual analysis products. F.O.S.

N71-12185# National Environmental Satellite Center, Washington, D.C.

ARCHIVING PROCEDURES AND DOCUMENTATION, APPENDIX D

In its Archiving and Climatological Appl. of Meteorol. Satellite Data Jul. 1970 32 p (See N71-12181 02-20)
Avail: SOD $1.25; NTIS

The archival procedures in use are summarized and satellite data available is listed in sufficient detail for planning climatological applications. The TIROS and ESSA data archiving have been grouped together for convenience. Archiving of ESSA satellite data follows a series of procedures developed sequentially, with the latest method incorporating the best features of the earlier archival procedures. The combination of TIROS and ESSA data archives provide the longest sequence available. The Nimbus and ATS data archives are described. Nimbus data archives provide unique data from this polar-orbiting satellite because the primary purpose of the Nimbus series is to flight-test advanced sensors. Spin-scan camera pictures available from ATS geosynchronous satellites provide unique data because of their frequent observations over the same geographical area. Author

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N71-11401*# Grumman Aerospace Corp., Bethpage, N.Y.

STUDY OF CONTROL MOMENT GYROSCOPE APPLICATIONS TO SPACE BASE: WOBBLE DAMPING AND ATTITUDE CONTROL SYSTEMS

Sep. 1970 516 p Prepared in cooperation with Sperry Phoenix Co.
(Contract NAS9-10427)
(NASA-CR-108672) Avail: NTIS CSCL 17G

The applicability of CMG (control moment gyro) systems for wobble-damping and attitude-control of the Space Base is discussed. The Space Base will be developed as an evolutionary outgrowth of the Space Station program. It is therefore valuable to know, before the CMGs for the Space Station are developed, what types and sizes of CMGs are required (if any) for the Space Base, so that unnecessary duplicate CMG development programs are avoided. Also, if the Space Base CMG requirements should turn out to be far beyond what is presently available or under development for other applications, it is valuable to provide as long a lead time as possible for the development of such CMGs. Author

N71-11427*# Foster-Miller Associates, Inc., Waltham, Mass.
A STUDY OF EXPERIMENTAL TECHNIQUES FOR PREALIGNING AND CLAMPING INERTIAL MEASUREMENT SENSORS WITHOUT MAJOR SYSTEM RECALIBRATION
Allen E. Armstrong and Dikrun Der Marderosian Oct. 1970 66 p
(Contract NAS12-2015)
(NASA-CR-111365) Avail: NTIS CSCL 17G

Techniques for prealigning and clamping inertial sensors were studied in a program aimed at the design and fabrication of a highly accurate and stable clamping system to hold the sensor and associated test hardware. One adjustable clamp interface and two fixed clamp interfaces were designed. A brief description of the basic systems considered is presented including the detailed design of a prototype sensor with clamp assembly, a description of the various assembly components and their salient design features, and a step-by-step test plan defining facility requirements and test procedures. Author

N71-11466*# Massachusetts Inst. of Tech., Cambridge. Engineering Projects Lab.
AN APPLICATION OF PREDICTOR DISPLAYS TO AIR TRAFFIC CONTROL PROBLEMS
William Bradford Rouse (M.S. Thesis) Sep. 1970 115 p refs
(Grant NGL-22-009-002)
(NASA-111372; DSR-70283-15) Avail: NTIS CSCL 17G

The feasibility of using a predictor display system to help solve terminal area air traffic control problems is investigated. A computer-based predictor display is proposed as an aid for the air traffic controller to use in guiding aircraft to the glidepath. It was determined that learning, in most cases, was faster with the predictor display. However, the difference in performance with and without the predictor display decreased as learning proceeded. The predictor display helped to reduce errors, but not task completion time. A prediction which was too long and displayed more than the necessary amount of information increased task completion time. The prediction display significantly improved performance for the easier tasks while it did not significantly improve performance for the more difficult tasks. Author

N71-11625*# Wisconsin Univ., Madison.
WOBBLE-SPIN TECHNIQUE FOR SPACECRAFT INVERSION AND EARTH PHOTOGRAPHY
Norman H. Beachley and John J. Uicker, Jr. *In its* Meteorol. Meas. from Satellite Platforms Aug. 1967 p 379–388 ref Revised
(See N71-11613 02-20)
Avail: NTIS CSCL 17G

If certain prescribed spacecraft moment of inertia relationships are maintained, a small cylindrical flywheel can be used to tilt a spin stabilized satellite with respect to its fixed angular momentum vector without inducing nutation and without changing the basic spin rate. A camera rigidly attached to such a tilting vehicle will have the same view as a pivoting camera in a satellite whose spin axis is fixed. This technique can be extended, if desired, to turn the satellite upside down, a very useful capability for spin-scan camera satellites using radiation-cooled instruments. The control flywheel, which can be located anyplace in the satellite, must have its axis of rotation perpendicular to the satellite spin axis. The total vehicle must have a cylindrical moment of inertia configuration, with its axis of symmetry also perpendicular to the vehicle spin axis, and parallel to the flywheel's axis of rotation. Author

N71-11756# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROBLEMS OF APPLIED GYROSCOPY: Selected Articles
S. S. Rivkin et al 17 Jul. 1970 63 p refs Transl. into ENGLISH from Vopr. Prikl. Giroskopii Sb. Dokl. (USSR), no. 4, 1968 p 33–57, 69–87
(AD-712229; FTD-HC-23-436-69) Avail: NTIS CSCL 17/7

Contents: Concerning the geometry of a directional gyroscope mounted on a swinging base; The generalized gyro instrument; and Empirical formulas for calculating the aerodynamic resistance of a gyroscope motor. TAB

N71-11757# Royal Aircraft Establishment, Farnborough (England).
THE INERTIAL GUIDANCE LAW OF THE ELDO LAUNCH VEHICLE: A GUIDE TO THE EQUATIONS AND DATA PREPARATION
M. J. W. Gage Feb. 1970 43 p refs Sponsored by ELDO
(RAE-TR-70032) Copyright. Avail: NTIS

The FE (Flat Earth) guidance laws that form part of the ELDO inertial guidance system are presented in detail together with the necessary procedures for data preparation. Results are given for the F9 mission, both for the inertial guidance in an open loop passenger role and in a closed loop active role. Author (ESRO)

N71-11760# Adaptronics, Inc., McLean, Va.
SELF-ORGANIZING CONTROL SYSTEM DEMONSTRATOR Final Technical Report, 1 Apr. 1968 – 1 Jul. 1969
Roger L. Barron and George C. Vieth, Jr. Wright-Patterson AFB, Ohio AMRL Jul. 1970 118 p refs
(Contract F33615-68-C-1394)
(AD-712099; AMRL-TR-69-89) Avail: NTIS CSCL 1/3

The report presents a summary of self-organizing controller SOC principles, the description of a laboratory Demonstrator Self- Organizing Control System, discussion of design alternatives considered prior to its fabrication, and a test procedure for verification of proper operation of the Demonstrator. This Demonstrator was developed to obtain physical proof of multivariable SOC principles pertaining to control of flight vehicles. It is also a research tool and instruction device for further exploration of SOC applications and comparative studies of manual and SOC control performance. Author (TAB)

N71-11761# Marconi Space and Weapon Systems Ltd., Camberley (England). Space and Instrumentation Div.
A SOLAR POINTING ATTITUDE CONTROL SYSTEM
J. J. Turner 1970 6 p Presented at the Brit. Interplanet. Soc. Symp. on Advanc. in Space Res. and Technol., London, Sep. 1970 Sponsored by Sci. Res. Council
Avail: NTIS

A description is given of a solar pointing attitude control system used for Skylark rocket payloads. After the performance requirements an outline is given of the system operation. Other aspects, such as roll position control and packaging of the system are briefly described. ESRO

N71-11762# Centre National d'Etudes Spatiales, Paris (France). Dept. Astronomie.
THE CASSIOPEE SYSTEM [LE SYSTEME CASSIOPEE]
C. Poher 1970 15 p In FRENCH Presented at the Space Symp., Rennes, France, 16–19 Jun. 1970; sponsored jointly by CNES, Centre de Perfectionnement Tech., and Fac. des Sci. de Rennes
Avail: NTIS

The CASSIOPEE system which is designed for attitude control of telescopes launched by sounding rockets is described. This system includes a gyroscopic unit for coarse aiming, stellar sensors for fine direction setting, and a pneumatic power unit for moving the equipment. Accuracy of direction keeping is discussed. ESRO

N71-11763# Royal Aircraft Establishment, Farnborough (England).
APPLICATION OF KALMAN FILTERING TO BARO/INERTIAL HEIGHT SYSTEMS
P. M. Barham and P. Manville Jun. 1969 24 p
(RAE-TR-69131) Copyright. Avail: NTIS

The problems of traditional baro/inertial height units are discussed. A Kalman filter is proposed and results are given for a mathematical model of the system. Author

N71-11764# Royal Aircraft Establishment, Farnborough (England).
TECHNIQUES FOR EARTH-POINTING ATTITUDE CONTROL OF A SPACECRAFT
W. G. Hughes and M. B. Barnes Apr. 1970 35 p refs Presented at the NATO Summer School on Earth Observation Satellites, Cambridge, Engl., Jul. 1969 Submitted for publication
(RAE-TR-70070) Copyright. Avail: NTIS

The attitude control techniques particularly applicable to earth-pointing spacecraft, covering horizon sensors and overall systems of the spinning, gravity-gradient, and fully stabilized varieties, are surveyed. Considerable attention is given to the gyrocompassing technique for spinning and fully stabilized vehicles. Author (ESRO)

N71-11766* National Aeronautics and Space Administration. Langley Research Station, Langley Station, Va.
COOPERATIVE DOPPLER RADAR SYSTEM Patent
James H. Schrader, inventor (to NASA) Issued 27 May 1969 (filed 17 Oct. 1967) 15 p Cl. 343-6.5; Int. Cl. G01s9/56
(NASA-Case-LAR-10403; US-Patent-3,447,154;
US-Patent-Appl-SN-676391) Avail: US Patent Office CSCL 17G

A Doppler radar system for avoiding midair collisions between aircraft is described. A protected aircraft carries a transmitter, a transponder, and a receiver. The intruding aircraft carries a transponder. Comparison of signals transmitted by the protected aircraft with return signals from the transponder of the intruding aircraft provides warning of the proximity of the aircraft and measures the distance separating the aircraft in time to take avoiding action. Author

N71-11768# Centre National d'Etudes Spatiales, Paris (France).
THE PROJECT DIOSCURES: GENERAL INTRODUCTION TO THE SYSTEM [LE PROJET DIOSCURES: INTRODUCTION GENERALE DU SYSTEME]
B. Manuali 1970 18 p refs In FRENCH Presented at the Space Symp., Rennes, France, 16–19 Jun. 1970; sponsored jointly by CNES, Centre de Perfectionnement Tech., and Fac. des Sci. de Rennes
Avail: NTIS

The DIOSCURES project aims at meeting the need of both the merchant navy and civil aviation on or over the Atlantic and Pacific Oceans. It provides for telephone and data links between ground stations and aircraft or ships via satellites. It also provides for means of plotting their movements for navigation control purposes. Five geostationary satellites are to be launched by 1973, two over the Pacific Ocean and two over the Atlantic Ocean plus one as a standby. ESRO

N71-12175# Air Force Logistic Command, Wright-Patterson AFB, Ohio. Packaging Evaluation Agency.
ENGINEERING DESIGN AND TEST OF PACKAGING SYSTEMS FOR THE 2171 GYROSCOPE PLATFORM
Edward P. Moravec and Matthew A. Venetos Jul. 1970 24 p refs
(AD-711384; DSPEB-29) Avail: NTIS CSCL 13/4

The objectives of the study were to evaluate the shock and vibration protection provided by a contractor designed packaging system for the 2171 Gyroscope Platform and, if required, to determine and recommend design changes for improved package protection. A deficiency was discovered in the contractors pack design which developed under certain conditions of handling. The deficiency was identified as a possible cause for the high damage rates and a method was recommended for correcting the deficiency. Author (TAB)

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N71-11408# United Kingdom Atomic Energy Authority, Harwell (England). Information Branch.
DEVELOPMENT OF NEUTRON RADIOGRAPHY WITHIN THE CEA
J. L. Boutaine Oct. 1969 15 p refs Transl. into ENGLISH from Bull. Inf. Sci. Tech. (Paris), no. 136, 1969 p 35–44
(NP-tr-1900) Avail: AEC Depository Libraries

In the swimming pool reactors at the Cadarache, Grenoble and Saclay Centers, neutron radiographic devices, using the principle of the immersed conical collimator, provide satisfactory means of examining the various systems designed for studying the different fuels and structural materials used in nuclear technology. The advantages and disadvantages of the neutron radiography method are described and some examples of their present-day practical use in nuclear technology are given as well as some suggestions for their use outside the nuclear field. The first results of research on the possibilities of using neutron generators and radioisotopic sources are described. Author (NSA)

N71-11409# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
SIMULATION OF FISSION EXPERIMENTS BY THE MONTE-CARLO METHOD [SIMULATION D'EXPERIENCES SUR LA FISSION PAR LA METHODE DE MONTE-CARLO]
Jean Poitou, Herve Nifenecker, and Claude Signarbieux Apr. 1970 48 p refs In FRENCH
(CEA-N-1282) Avail: AEC Depository Libraries

A Monte-Carlo program which simulates the fission process with prompt neutron emission and the detection of these neutrons in a large liquid scintillator are presented. The interest of this program lies essentially in its ability to optimalize the scintillator geometry (different shapes have been investigated) to provide the best separation between the neutron components emitted from either of the fission fragments. This program also allows one to compute the detecting efficiency as a function of the initial velocity and the direction of the neutrons. Author (NSA)

N71-11410# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorbauelemente.
EXPERIMENTAL DETERMINATION OF THE PRESSURE LOSS IN A 37 ROD BUNDLE OF TUBES WITH 6 INTEGRAL SPIRAL RIBS PER ROD AS SPACERS [EXPERIMENTELLE BESTIMMUNG DES DRUCKVERLUSTES AN EINEM 37-STABBUENDEL AUS ROHREN MIT 6 INTEGRALEN WENDELRIPPEN PRO STAB ALS ABSTANDSHALTER]
H. Tschoeke Feb. 1970 31 p refs In GERMAN; ENGLISH summary
(KFK-1038) Avail: AEC Depository Libraries

The losses consist of inlet, bundle, and outlet pressure losses. The studies were made in air, and the Reynolds range was $2,000 < R < 100,000$. The measurement results for the bundle inlet resistance coefficient zeta sub E = 0.4 indicate that 40% of the pressure head in the bundle inlet are necessary supplementary to the acceleration pressure loss in order to form the inlet pressure difference. The outlet coefficient of resistance zeta sub A = 0.5 indicates that 50% of the pressure head in the bundle end must be withdrawn from the loss-free pressure gain in order to build the outlet pressure difference. The surface ratio F sub H/F sub S studied at the outlet is of some importance. If the cross section in the outlet channel is increased 5 times of the single free bundle cross section, the resistance coefficients are reduced about 20%. On an example calculated from the experimental results, it is shown that about 10% of the total pressure loss of the bundle occurs by inlet and outlet losses. Author (NSA)

N71-11413# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Angewandte Reaktorphysik.

DIRECT ELECTRICALLY HEATED UO2 FUEL RODS [DER DIREKT ELEKTRISCH GEHEIZTE UO2-BRENNSTAB]

D. Freund and W. Schikarski Feb. 1970 47 p refs In GERMAN; ENGLISH summary
(KFK-1031) Avail: AEC Depository Libraries

The new method described allows heating of sintered UO2-rods by direct electric current without an internal axial metallic resistance heater. The temperature distribution of a direct electrically heated UO2-rod is calculated by means of a digital computer program based upon radial power balance. The comparison between the direct electrically heated rod and the nuclear reactor fuel rod shows that a good simulation of the nuclear fuel temperature distribution can be achieved. Experimental and measuring devices are described. The stationary electrical heating of the UO2-pin with electrical energy requires a power controlled circuit. The dynamic conditions are simulated by a pulse current taken from a bank of capacitors. The method allows investigations on thermal and thermodynamic behavior of UO2-fuel pins. Author (NSA)

N71-11469*# Scientific Translation Service, Santa Barbara, Calif.

A STUDY ON HOT SPOT FACTORS AND THE DEGREE OF UNCERTAINTY IN THERMAL DESIGN OF REACTOR CORES

Yoshiaki Miyamoto Washington NASA Nov. 1970 21 p refs Transl. into ENGLISH from Nippon Genshiryoku Gakkaishi (Tokyo), v. 12, no. 4, Apr. 1970 p 179–186
(Contract NASw-2035)
(NASA-TT-F-13390) Avail: NTIS CSCL 18K

A method of calculating the hot spot factor is presented. The uncertainties in the design variables are classified. Statistical and cumulative treatments of the hot spot factor are discussed. The method of calculating the hot spot factor is obtained for the case where the design variable does not agree with the mean value of the stochastic variable, and it is verified that a procedure analogous to the normal statistical treatment is applicable. As one example, the hot spot factor for a fuel element of pellets in a cladding tube is calculated by the statistical technique. In this case, a correction is necessary for the index of the variable; this correction factor is obtained for the case of a sine or cosine power distribution in the axial direction. Author

N71-11629# Space Nuclear Propulsion Office SNPO, Atomic Energy Commission, Germantown, Md.

MANUFACTURE AND DESIGN TECHNOLOGY NERVA

William R. Slivka *In* AGARD Advanced Technol. for Production of Aerospace Eng. Sep. 1970 25 p refs (See N71-11626 02-28)
Avail: NTIS

During the technology phase of the Nuclear Rocket Program several unique and technically challenging design and manufacturing procedures were developed to produce nuclear rocket engine hardware. Discussed are manufacture and non-destructive testing techniques used in the manufacture of some of these items which included a large Hastelloy-X U-tube rocket nozzle, a beryllium reactor reflector, graphite fuel elements and graphite-carbide composite reactor parts. The function and construction of an altitude simulator system used in the testing of nuclear rocket engines is also discussed. Author

N71-11732*# International Research and Technology Corp., Washington, D.C.

ON THE PRODUCTION AND SEPARATION OF INDUSTRIALLY USEFUL ISOTOPES IN SPACE

Theodore B. Taylor *In* NASA. Marshall Space Flight Center Space Process. and Manufacturing 21 Oct. 1969 p 499–509 (See N71-11701 02-15)
Avail: NTIS CSCL 18B

Preliminary work on a concept of an orbital facility for production and separation of industrially useful isotopes will be discussed. The production facility consists of a large solar powered electrical generator and a high current charged particle accelerator that produces isotopes by bombardment of a suitable target. Several possible methods for chemical or physical separation of the produced isotopes in space will be discussed. Emphasis will be placed on the production of plutonium or uranium-233 for use in terrestrial power reactors. Possible advantages of an orbital facility over a terrestrial one will be discussed. Author

N71-11733# Idaho Nuclear Corp., Idaho Falls.

SECHT-4: PERFORMANCE EVALUATION OF STAINLESS STEEL AND ZIRCALOY-CLAD ELECTRICALLY POWERED HEATERS

J. L. Plum Jun. 1970 49 p refs
(Contract AT(10-1)-1230)
(IN-1378) Avail: NTIS

The Scoping Emergency Cooling Heat Transfer (SECHT) Project was a parametric experimental study of bottom and top flooding modes of emergency core cooling for nuclear fuel assemblies. Four series of tests were conducted using electrically powered heaters to simulate nuclear fuel pins. Heaters for the first three series were clad with relatively inexpensive stainless steel. Zircaloy, the normal cladding material for nuclear fuel pins, was used as the cladding for heaters utilized for the SECHT-IV series of tests described in this report. This series consisted of a limited number of tests conducted to obtain thermal-response data from Zircaloy-clad heaters operated at conditions similar to those of selected tests of the SECHT-III series. Tests were conducted at different initial cladding temperatures ranging from 1000 to 1800 F; all other parameters of interest were held constant. Data from comparable tests of the two series were used to evaluate the relative thermal response of heaters clad with the two different materials but otherwise identical. This evaluation verified that for initial cladding temperatures up to 1800 F, stainless steel may be substituted for Zircaloy as a cladding material for electric heaters to be used as simulators for nuclear fuel pins. Author (NSA)

N71-11734*# Translation Consultants, Ltd., Arlington, Va.

CONTRIBUTION TO THE STUDY OF THE FISSION-GAS RELEASE IN METALLIC NUCLEAR FUELS [CONTRIBUTION A L'ETUDE DU DEGAGEMENT DES GAZ DE FISSION DANS LES COMBUSTIBLES NUCLEAIRES METALLIQUES]

B. Kryger (Ph.D. Thesis—Conservatoire Natl. des Arts et Metiers, Oct. 1969) Washington NASA Nov. 1970 72 p refs Transl. into ENGLISH of CEA, Fontenay-aux-Roses, France, report CEA-R-3888
(Contract NASw-2038)
(NASA-TT-F-13339; CEA-R-3888) Avail: NTIS CSCL 18K

In order to study the effect of an external pressure for limiting the swelling due to fission-gas precipitation, irradiations were carried out at burn-ups of about 35,000 MWd/ton and at average sample temperatures of 575 C on nonalloyed uranium and uranium-8 percent molybdenum in a thick stainless steel can. A cylindrical central hole permitted fuel swelling from 20 to 33% according to the experiment. After irradiation, the uranium samples showed two types of can rupture, one due to the fuel swelling, and the other due to the pressure of the fission gases released through a network of microcracks. The cans of the uranium-molybdenum samples were all undamaged, and it is shown that the gas release occurs by interconnection of the bubbles for swelling values higher than those obtained in the case of uranium. For each type of fuel, a swelling-fission gas release relationship was established. The results suggest that good performances with a metallic fuel intended for use under fast reactor conditions can be obtained. Author

N71-11737# Gulf General Atomic, San Diego, Calif.

IRRADIATION BEHAVIOR OF NUCLEAR GRAPHITES AT ELEVATED TEMPERATURES

G. B. Engle 4 Mar. 1970 67 p refs Submitted for publication
(Contract AT(04-3)-167)
(PB-193492; GA-9972) Avail: NTIS CSCL 18J

Graphite continues to be a useful material for the moderator, the reflector, and structural components in high-temperature nuclear reactors. Significant effects to be considered in the design of reactor components are the changes in dimensions and properties that occur when graphite is exposed to high-energy neutrons at elevated temperatures. The report studies the dimensional changes which become particularly significant above 800 degrees C and at fluences of 5 to 10 × 10 to the 21st power n/sq. cm. Author (USGRDR)

N71-11739# Eidgenoessiches Institut fuer Reaktorforschung, Wurenlingen (Switzerland).

LONG-TIME RELATION OF THERMAL REACTOR WITH PARALLEL AND CROSSED ARRANGEMENTS OF FUEL ELEMENTS [LANGZEITVERHALTEN THERMISCHER REAKTOREN MIT PARALLELER UND GEKREUZTER ANORDNUNG DER BRENNSTOFFELEMENTE]

J. Brunner May 1970 83 p refs In GERMAN
(EIR-182) Avail: AEC Depository Libraries

The possibility of reducing the energy production costs by a uniform stress of the fuel elements in a thermal reactor with a crossed arrangement of the coolant channels is investigated. The studies are limited to systems with a single type of fuel element. In connection with the heat removal from the biaxial systems, the problems of the optimum carrying out of the two-material process are studied and several reactor variants are investigated by means of approximation calculations. Construction questions are not considered. A comparison of the burnup is made between the cross-lattice concept and cylinder reactors. NSA

N71-11740# Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.

EFFECTS OF FAST NEUTRON IRRADIATION ON THE PERFORMANCE CHARACTERISTICS OF REACTOR-GRADE THERMOCOUPLES

N. C. Hoitink, R. C. Weddle, and D. C. Thompson Jun. 1970 42 p refs
(Contract AT(45-1)-1830)
(BNWL-1365) Avail: NTIS

Irradiation of 55 Chromel/Alumel thermocouples in the EBR-2 reactor to a total fast neutron fluence of about 7 × 10 to the 21st power nvt and subsequent testing provided significant information regarding anticipated performance of such sensors in a fast flux reactor environment. The tested 0.0625-in. diameter, stainless steel sheathed, MgO insulated sensors included both insulated and grounded junction construction. Tests performed before and after irradiation included wire resistance and insulation measurements, emf versus temperature calibration, and time response determination. Test results revealed negligible change in wire resistance and characteristic time constant values; decreases of up to 10,000 ohms in insulation resistance (due in part to seal failure); and changes in emf versus temperature calibration of up to about 1%. Author (NSA)

N71-11770# Kyoto Univ. (Japan). Reactor Research Inst.

PREPARATION OF IN-CORE FLOW-METERS AND MEASUREMENTS OF THE CORE FLOW DISTRIBUTIONS OF KYOTO UNIVERSITY REACTOR

Masaaki Sugimoto 27 Dec. 1969 10 p refs In JAPANESE; ENGLISH summary
(KURRI-TR-72) Avail: AEC Depository Libraries

Two kinds of coolant flow-meters were prepared for measurements of flow-rate distributions in the fuel elements of the reactor core under conditions of forced circulation cooling and natural convection cooling. A turbine type flow-meter was suitable for the measurement on the forced cooling, and it gave a good proportionality between the flow-rate and the revolution speed in digital counts. On the other hand, a thermocouple type of velocity meter was applied to the measurements of the natural convective flow of water, and it showed much availability in the small velocity range of a few cm/sec, even under water temperature fluctuations. The homogeneous flow distributions under the forced cooling and the large convective flow were compared to the designed value of KUR. Additionally, a flow-speed of about 1 cm/sec was noticed during the shutdown condition. This was explained by the convective flow due to the decay-heat of the core. Author (NSA)

N71-11781*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXPERIMENTAL INVESTIGATION OF CONDENSER PRESSURE CONTROL DURING SNAP-8 STARTUP. 1: INVENTORY CONTROL OF CONDENSING PRESSURE

Roy C. Tew and Roland C. Fisher Washington Nov. 1970 24 p refs
(NASA-TM-X-2114; E-5731) Avail: NTIS CSCL 18N

An inventory method for controlling the mercury condensing pressure during SNAP-8 startup was tested. With this method liquid mercury flows into or out of the system, maintaining pressure equilibrium with a constant pressure reservoir. It was found that to have adequate control sensitivity, the control must operate in the high inventory region of the condenser. Also, the condenser coolant (NaK) flow schedule was found to be a critical factor in achieving satisfactory control during startup. Pressure control was satisfactory for some of the startups; however, it appears doubtful that a NaK flow ramp to the self-sustaining level can be found which would allow satisfactory control for the expected variety of startups. Author

N71-11782# Atomics International, Canoga Park, Calif.

DEPOSITION OF CESIUM AND BARIUM IN A SODIUM-STAINLESS STEEL SYSTEM

J. Guon 30 Jun. 1970 78 p refs
(Contract AT(04-3)-701)
(AI-AEC-12952) Avail: NTIS

Quantitative results have been obtained on the deposition of cesium and barium in a sodium-stainless steel system. For the first time, sufficient detail has been obtained to predict, with some confidence, the distribution of fission product cesium and barium released to a Liquid Metal Fast Breeder Reactor (LMFBR) system as a result of fuel cladding failure. Some insight has been developed into the processes occurring during deposition. Author (NSA)

N71-11783# Atomic Power Development Associates, Inc., Detroit, Mich.

SUMMARY OF THE APDA SODIUM TECHNOLOGY PROGRAM

J. E. Meyers Jun. 1970 71 p refs
(Contract AT(11-1)-865)
(APDA-259) Avail: NTIS

An eight-year sodium technology program conducted in the APDA Sodium Technology Loop is summarized. Development of impurity monitoring devices such as the UKAEA Rhometer, the UNC oxygen meter, the APDA hydrogen detector, and the APDA variable-orifice plugging meter is described along with impurity removal processes such as cold-trapping, hot-trapping, and operation of the APDA-developed sodium centrifuge. Results of investigations of the physical and chemical behavior in sodium of impurities such as hydrogen and sodium carbonate are included. Sampling and analysis procedures, including a sampling reliability study for oxygen and hydrogen; a round robin program for measuring oxygen in sodium; a uranium gettering technique for measuring the oxygen content of sodium; and analytical methods for determining oxygen, total carbon, carbonate carbon, and hydrogen are described. Author (NSA)

N71-11784# Atomics International, Canoga Park, Calif.
FUELS, MATERIALS, AND COOLANT CHEMISTRY PROGRAMS Quarterly Technical Progress Report, Jan. – Mar. 1970
E. W. Murbach and D. F. Atkins 15 May 1970 103 p refs
(Contract AT(04-3)-701)
(AI-AEC-12948) Avail: NTIS

Results of investigations are presented on fuel cladding and structural materials, Na effects on stainless steel, Na reactions with test materials in loops, radiation effects on reactor materials, properties of mixed carbide fuels, Na chemistry, and fission product contamination. NSA

N71-12109# General Electric Co., Pleasanton, Calif. Nucleonics Lab.
THERMODYNAMIC DATA PROGRAM INVOLVING PLUTONIA AND URANIA AT HIGH-TEMPERATURES Quarterly Report, Dec. 1969 – Feb. 1970
E. A. Aitken and S. K. Evans Apr. 1970 4 p refs
(Contract AT(04-3)-189)
(GEAP-12066; QR-10) Avail: NTIS

Results of work related to vaporization of urania, oxygen redistribution in a temperature gradient, and sodium fuel interactions are presented. The scope of new experiments to extend the study of oxygen activity in UO2-PuO2 systems to higher temperatures is described. Author (NSA)

N71-12110# Environmental Research Corp., Alexandria, Va.
OBSERVED SEISMIC DATA: JORUM EVENT
Apr. 1970 90 p refs
(Contract AT(29-2)-1163)
(NVO-1163-207) Avail: NTIS

Results of the processing of the observed ground motions from the Jorum event, a contained underground nuclear device detonated on Pahute Mesa at the Nevada Test Site, are presented. For the purpose of evaluating ground motion prediction procedures used for Jorum, the event yield was assumed to be approximately 1 megaton. Using this assumed event yield, the observed peak resultant vector particle amplitudes as a function of distance are compared with what would be predicted for an event of 1 megaton yield. Similarly, observed 5% pseudo-relative velocity spectra of the horizontal component (radial or transverse) having the peak response are compared with the spectra that would be expected from a 1 megaton event. Data recorded at 41 instrument locations were processed. Author (NSA)

N71-12127# Philippine Atomic Energy Commission, Manila. Research Center.
PRR-1 FUEL ELEMENTS (SECOND BATCH)
Guillermo C. Corpus Aug. 1969 39 p
(PAEC(D)-699) Avail: AEC Depository Libraries

Twenty replacement flat-plate fuel element assemblies were fabricated for PRR-1 second core loading. Ten assemblies contain 155 grams U-235 per element, the other ten, only 137 grams. A 21st element with 137 grams U-235 came in as loose fuel plates only. Ninety-three per cent enriched uranium metal was alloyed with aluminum to about 11.9 weight percent of uranium utilizing 23 separate melt batches. Information on uranium contents, enrichment, uranium to Al ratio, and melt number for each fuel plate is presented. Author

N71-12128# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Angewandte Reaktorphysik.
SODIUM-AIR REACTIONS AS REACTOR INTERFERENCE EVENT [NATRIUM-LUFT-REAKTIONEN ALS REAKTORSTOERFALL]
Karl Keller Jan. 1970 40 p refs In GERMAN
(KFK-1034) Avail: AEC Depository Libraries

Temperature and pressure patterns of sodium-air reactions were derived as functions of the type of sodium burning. The consequences for the containment-charge were indicated. In particular the reacton rates for the various relevant chemical reactions were studied as a function of the reactor incident or the type of sodium burning. Author (NSA)

N71-12179# Skoda Works, Pilsen (Czechoslovakia). Nuclear Power Plants Div.
EXPERIMENTAL GAS LOOP
Jan Martinek and Karel Novotay 1970 24 p
(ZJE-68) Avail: AEC Depository Libraries

The design of an experimental loop and the experience gained in the putting of it into operation are described. A summary of the technical parameters of the individual technological components of the loop and a description of the modes of operation of its individual circuits are given. The possibilities of utilizing existing equipment for experiments requiring a source of gas under pressure and prespective extension of the experimental base in future years are discussed. Author (NSA)

N71-12186# Babcock and Wilcox Co., Lynchburg, Va. Research and Development Div.
GEL-ADDITION PROCESS CHEMICAL STUDIES Quarterly Progress Report, Feb. – Apr. 1970
R. V. Carlson, comp. Jun. 1970 38 p refs
(Contract AT(30-1)-3714)
(BAW-3714-17; QPR-15) Avail: NTIS

The development of a sol-gel process and related processes for the preparing (U,Pu)O2 fast reactor fuels has continued. Progress for the 15th quarter, ending April 30, 1970, is reported. Sufficient (U,Pu)O2 fuel was prepared for the initial bundle to be irradiated in the EBR-2. About 450g of coarse U-235(O2) 20% PuO2 microspheres was formed in the unit-operation-scale spheroidizing system, and about 350g of fines was formed in laboratory-scale equipment. Since the first lot of copreciptated U-235(O2) – 20% PuO2 powder was found to have a high aluminum coment, a new lot containing about 2.2 kg of powder was prepared. Sufficient fuel pellets and shards for the initial EBR-2 irradiation test were fabricated from the second lot of powder. A capsule in the time-for-restructuring series was placed in the BAWTR for an 81-day irradiation of 6 kW/ft. It was removed after 55 days when abnormal operating temperatures were indicated. Author (NSA)

N71-12187# United Nuclear Corp., Elmsford, N.Y. Research and Engineering Center.
FAST REACTOR MIXED-CARBIDE FUEL ELEMENT DEVELOPMENT PROGRAM Quarterly Progress, Jan. – Mar. 1970
May 1970 44 p
(Contract AT(30-1)-3415)
(UNC-5259; QPR-11) Avail: NTIS

Three helium-bonded high-density (UPu)C + 10 vol % (UPu)2C3 fuel rods were discharged from the EBR-2 after accumulating a burnup of 73,000 MWd/t at 20 kW/ft. The results of the destructive post-irradiation examination of Type 316 stainless steel- and Incoloy 800-clad fuel rods irradiated to 40,000 and 57,000 MWd/t are given. Sintered high-density plutonium carbide-uranium carbide pellets were prepared. A parametric study is being performed to evaluate mixed carbides under transient conditions. NSA

N71-12188# Battelle Memorial Inst., Columbus, Ohio.
HIGH-TEMPERATURE FUELS TECHNOLOGY Quarterly Report, Feb. – Apr. 1970
Donald L. Keller and Walston Chubb May 1970 65 p refs
(Contract W-7405-eng-92)
(BMI-1884) Avail: NTIS

The gas pressure in the plenum of a 90 percent dense specimen of UO2 operating at a surface temperature of 1525 C remained constant at 23 psi to a burnup of 0.27 × 10 to the 20th power fissions per cu cm. At that burnup the pressure began to rise at a rate indicating essentially 100 percent gas release to a pressure of 42 psi at a burnup of 0.63 × 10 to the 20th power fissions per cu cm. The delay in the onset of gas release is tentatively ascribed to a need for time to develop channel-type porosity suitable for releasing fission gas. A second capsule loading of UN specimens irradiated at temperatures of 1400 to 1600 C has shown external volume increases of less than 4 percent at a burnup of about 2.1 × 10 to the 20th power fissions per cu cm. This material was maintained nitrogen-rich with an overpressure of nitrogen gas. Because of the small volume changes, no external effect of porosity or of grain size was distinguishable. However, as noted last quarter, microstructural examination disclosed a strong tendency for porosity to develop preferentially in the grain boundaries of the UN. Author (NSA)

N71-12189# MSA Research Corp., Evans City, Pa.

THE EFFECT OF HIGH-TEMPERATURE SODIUM ON THE MECHANICAL PROPERTIES OF CANDIDATE ALLOYS FOR THE LMFBR PROGRAM. TECHNIQUES FOR MONITORING HIGH CARBON ACTIVITY SODIUM: AN EVALUATION OF THE UNC CARBON METER

S. J. Rodgers and R. J. Shreve May 1970 97 p refs
(Contract AT(11-1)-765)
(MSAR-70-54; XAC-720452; Rept-16) Avail: NTIS

Techniques for monitoring carbon as a contaminant in sodium are discussed. Monitoring tabs, plugging-indicator curves, and chemical analyses, while useful techniques in system operations, did not provide either an instantaneous or a continuous method for monitoring carbon or, more importantly, carburization potential. The UNC carbon meter is the newest monitoring technique. The results of the first field test appeared most promising. The carbon meter output can be related to carburization of austenitic steels. The problems associated with the installation and operation of the UNC carbon meter are discussed. The problems included instrument operation, gas flow control, and measurement and control of moisture content in the gas. The adjustment of carbon activity level and its maintenance by control of the temperature and flow parameters in a bed of graphite rods is presented. A calibration curve of the carbon meter output against the carburization of 5-mil, 304 stainless steel tabs was accomplished. Author (NSA)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N71-11745# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

APPLICATION OF THE CONCEPT OF A TRIHEDRON ROTATING AT VARIABLE SPEED TO MAGNETIC RESONANCE MODULATION [APPLICATION DE LA NOTION DE TRIEDRE TOURNANT A VITESSE NON CONSTANTE A LA MODULATION EN RESONANCE MAGNETIQUE]

Guy Hanuise 1970 7 p refs In FRENCH Presented at the 16th Colloq. "Ampere," Bucharest, 1-5 Sep. 1970 Submitted for publication
(ONERA-TP-866) Avail: NTIS

The concept of the rotating trihedron at variable speed, already used in the theory of the nuclear induction rate-gyro, is used for modulating at low frequency the director field in such a way that the components of this field are static along two perpendicular directions of this trihedron. The solution is then found by the classical Bloch equations. ESRO

N71-11773# Southampton Univ. (England). Inst. of Sound and Vibration Research.

SIMULATION OF CONTINUOUS RANDOM PRESSURE FIELDS BY POINT SOURCES

M. S. Rosser and C. A. Mercer Feb. 1970 39 p refs
(ISVR-TR-32) Avail: NTIS

The acoustic simulation of a random pressure field over a region of space, initially assumed to be in an anechoic environment, is considered. The field is taken to be prescribed in terms of power spectral densities at a number of effect points in the region, together with the cross spectral densities, expressed jointly as a spectral density matrix. For equal numbers of source and effect points it is possible to relate the two spectral density matrices by means of an acoustic receptance matrix, elements of which are analogous to structural receptances used in the analysis of response to random forces. A technique is developed for generating the noise signals from a number of similar but independent white noise signals, these being suitably filtered and mixed to produce the calculated direct and cross power spectra. Basic computer programs are given, results are summarized, and indications are given of the directions in which further work should proceed. Author (ESRO)

N71-11774# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

THEORETICAL AND EXPERIMENTAL STUDY OF THE SPACE-TIME STRUCTURE OF ACOUSTIC WAVES IN A DUCT [ETUDE THEORIQUE ET EXPERIMENTALE DE LA STRUCTURE SPATIO-TEMPORELLE DES ONDES ACOUSTIQUES DANS UN CONDUIT]

Patrick Harel and Mariano Perulli 1970 38 p refs In FRENCH; ENGLISH summary Presented at the Symp. on Reduction of Blowers Noise by Acoust. Tech., Paris, 16 Mar. 1970 Submitted for publication
(ONERA-TP-844) Avail: NTIS

In a cylindrical duct with a permanent, uniform, axial fluid flow, a study is made of the acoustic propagation of vibratory modes whose damping length is greater than the longitudinal wavelength. The propagation conditions and the space-time structure of the modes are studied as a function of the flow velocity and of the wall impedance. In particular, the modes whose phase velocity is of opposite sign to the ground velocity are emphasized. The damping and the upstream-downstream repartition of the excitation energy are also studied as a function of these parameters. After a description of the principle of the vibratory mode wavelength measurement, the preliminary results are presented of the longitudinal and azimuthal wavelengths, and of the radial numbers of harmonic frequencies of f sub 1 = BN (B: number of mobile blades; N: number of revolutions per second). These modes are extracted, with the aid of filters, from the noise of a shrouded blower. The variation of the spatial structure of those modes along the duct axis is particularly examined. Author (ESRO)

N71-11775# ARO, Inc., Arnold Air Force Station, Tenn.

SORPTION PUMPING OF HYDROGEN BY CRYODEPOSITS: DYNAMIC PUMPING CHARACTERISTICS Final Report, Apr.-Sep. 1969

K. E. Tempelmeyer AEDC Oct. 1970 78 p refs
(Contract F40600-71-C-0002)
(AD-712373; AEDC-TR-70-102; ARO-VKF-TR-70-102) Avail: NTIS CSCL 20/13

The sorption for cryodeposited frosts for hydrogen has been investigated both analytically and experimentally. Most of the experimental tests were carried out with carbon dioxide frost at temperatures between 12 and 22K as the cryosorbent and hydrogen at 300K as the sorbate. Dynamic pumping characteristics of the sorbent-sorbate combination were systematically measured for chamber pressures between 10 to the minus 7th power and .001 torr. Additional experimental results were obtained with sulphur dioxide and methyl chloride cryosorbents. An initial hydrogen pumping speed of 30 liters/sq cm-sec was measured for 12K carbon dioxide frost which was equivalent to an initial effective capture probability of about 0.7. The initial pumping speed appears to be governed by the sorbent, sorbate-surface interaction and may be increased somewhat by forming the surface in a manner to make it smoother but at the consequence of an attendant loss of sorption capacity. The pumping speed of a frost cryosorbent decreases with increasing amount of gas sorbed. A model of the sorption dynamics was formulated. An approximate closed-form solution was obtained in the limit of rather compact frosts whose sorption behavior would be limited by ability of the molecules to penetrate and diffuse into the frost. Comparisons between theory and experiment indicated that the diffusion constant for hydrogen in a variety of cryodeposits varied from 10 to the minus 8th power to 10 to the minus 15th power sq cm/sec. Also, it was noted that carbon dioxide and sulphur dioxide frosts deposited at temperatures below 30K appear to undergo some crystal transition if their temperature is increased to above 30K. Author (TAB)

N71-11776# Texas Univ., Austin. Acoustics Research Lab.

NEARFIELD AND FARFIELD INVESTIGATION OF THE PERFORMANCE OF PLANAR ARRAYS OF PISTON-TYPE SOUND SOURCES

George J. Gruber and Gu-Din Tseo 30 Mar. 1970 166 p refs
Sponsored in part by ONR and NSF
(Grant AF-AFOSR-1792-69)
(AD-711367; TR-84; AFOSR-70-1651TR) Avail: NTIS CSCL 20/1

Nearfield and farfield measurements were performed on scale model-linear- and hexagonal underwater sound arrays of acoustically small elements (ka approximately 1). The measurements included the head velocities of the elements, surface pressure and far-field pressure. The linear superposition of the acoustical interaction effects was studied and proved to be valid. A simple method to predict the final velocities of the interacting elements was established by using the modified-transfer-coefficient concept. Author (TAB)

N71-11777# Northwestern Univ., Evanston, Ill. Dept. of Physics.

STATISTICAL MECHANICS OF HARD PARTICLE SYSTEMS

Emmanuel Meeron and Arnold J. F. Siegert [1970] 56 p refs
Sponsored by NSF
Avail: Issuing Activity

The concept of the equivalence of a hard particle (depending on the number of dimensions: hard sphere, disc, or rod, with no attractive interaction) of diameter a in a system of hard particles, and a spherical cavity of radius at least a, is extended to define given distribution functions for sets of n cavities in a hard particle system. A theorem relating the excess chemical potential of a hard particle system to the distribution function of two cavities at zero separation as well as corresponding theorems for higher order distributions, are derived. The given theorems and some simple physical arguments are used to obtain an approximation to the exact Born−Green−Yvon equation for the pair stress approximation (PSA). The resulting simple equation of state yields very good approximate values for the fourth and fifth virial coefficients for hard discs, and for the fourth virial coefficient for hard spheres. All the given approximations become exact for hard rods in one dimension, and the method yields the known expressions for the equation of state and pair distribution function for this system in a particularly simple way. Author

N71-11778# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

REGISTRATION OF COHERENT LIGHT FLUXES

V. V. Artemev et al 17 Jul. 1970 11 p refs Transl. into ENGLISH from Izv. Sib. Otd. Akad. Nauk SSSR, Ser. Tekh. Nauk (USSR), v. 13, no. 3, 1968 p 106−109
(AD-712231; FTD-HT-23-295-70) Avail: NTIS CSCL 20/6

The correlation characteristics of signals at a photomultiplier output in the presence of monochromatic illumination are discussed, and the results of the study on their correlation characteristics given. It is shown that correlation of the photons of ruby-laser radiation can be used when registering them in the presence of background noise. Author (TAB)

N71-11779# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.

MEASURING YOUNG'S MODULUS IN PHOTOELASTIC MATERIALS

J. E. Tepera May 1970 15 p refs
(Contract N00014-68-A-0515)
(AD-711799; THEMIS-SMU-TR-74) Avail: NTIS CSCL 20/1

A technique of determining the modulus of elasticity of a birefringent material by means of sound wave transmission is discussed. In the experiment, the sound wave velocity is obtained by measuring the change in the transmitted polarized light field intensity at two separate spatial locations along the length of the specimen by means of photomultiplier tubes and a cathode ray oscilloscope and camera. The relationship between the sound velocity, density, and modulus of elasticity of the material is used to calculate the latter quantity. The technique was applied to a typical low modulus (750 psi) photoelastic material, urethane rubber (PSM-4) and the measured value of the modulus of elasticity is compared to values obtained from cumbersome and slow static stress-strain measurements and to the value published by the manufacturer. The technique lends itself very well to application in either a high or low temperature environment. Author (TAB)

N71-12129# Naval Research Lab., Washington, D.C.

PROCEEDINGS OF THE 1970 ULTRALOW TEMPERATURE SYMPOSIUM

Robert A. Hein, D. U. Gubser, and E. H. Takken, eds. Apr. 1970 136 p refs Conf. held at Washington, D.C., 23−24 Apr. 1970; Sponsored in part by ONR and NRL
(AD-712061; NRL-7133) Avail: NTIS CSCL 20/13

Reports were presented on: A history of paramagnetic cooling; Historical survey of nuclear cooling; Historical survey of other means of cooling below 0.3 K; Thermometry at ultralow temperature; Thermal contact and isolation; Theory of He3-He4 dilution refrigerators; Practical consideration of He3-He4 refrigerators; Uses of dilution refrigerators; Experiments of the future of ultralow temperatures (<0.3 K); Nuclear cooling combined with dilution refrigeration; Hyperfine enhanced nuclear cooling in metallic materials; Superconducting flux detector applied to thermometry in the 1-mK range; Superconducting quantum interference nuclear thermometer; The importance of dipole-dipole interactions in ultralow temperature physics; Nonlocal effects in clean type II superconductors at ultralow temperatures; A particular use of a dilution refrigerator; and Predictions for helium film creep at ultralow temperatures. TAB

N71-12146# Air Force Cambridge Research Lab., Bedford, Mass.

SPACE-CHARGE LIMITATION OF SECONDARY ELECTRON EMISSION CURRENTS PRODUCED BY HIGH ENERGY RADIATIONS

Peter D. Gianino 24 Jul. 1970 69 p refs *Its* Phys. Sci. Res. Papers No. 422
(AD-712053; AFCRL-70-0418) Avail: NTIS CSCL 20/3

Secondary electron emission is an important consideration in radiation hardening of electronics. Basic information on this phenomenon, its influence, and the factors that affect its magnitude are required. Space-charge effects on the low-energy, secondary-electron emission currents flowing within any evacuated, two-electrode, plane-parallel system bombarded by KeV or MeV electrons or photons are treated in this report. The secondary emission from each irradiated electrode is assumed to be representable by a Maxwellian distribution, as is done in thermionic electron emission. This permits the complete analytical solution for the thermionic problem to be carried over in its entirety to the secondary case. The principal objective is to determine the net current density between the electrodes J sub c, given the saturation current density J sub s, or vice-versa, under known geometrical and electrical conditions. It is found that d(2) J sub o, where d is the electrode separation, is a useful parameter for characterizing space-charge effects in a parallel-plate geometry system. Generalized graphs employing this parameter are presented so that the results derived here can be readily applied to cases of interest; they permit the determination of threshold voltage conditions for space-charge limitation and partial retardation effects in a diode configuration. Other graphs show the variation of d(2) J sub c with applied voltage. These theoretical predictions are compared to data derived from some AFCRL experiments, in which foil electrodes of aluminum, tantalum and gold were irradiated by 60Co gamma-rays and 10 MeV electrons. Author (TAB)

N71-12160# Naval Underwater Systems Center, New London, Conn. Radio Communicatons System Div.

ELECTROMAGNETIC FIELDS PRODUCED BY A LONG, HORIZONTAL ELECTRIC LINE SOURCE ABOVE A REACTIVE SURFACE

Dennis E. Fessenden 10 Jul. 1970 12 p refs
(AD-712057; NUSC/NL-3000) Avail: NTIS CSCL 20/14

Expressions for the electric field produced by a long, horizontal electric line source above a reactive surface have been derived for both the nearfield and the farfield ranges. The reactive surface simulates, in a rather crude manner, a sinusoidal type of sea surface. Author (TAB)

N71-12172# , RAND Corp., Santa Monica, Calif.

ON THE MUTUAL COHERENCE FUNCTION OF AN OPTICAL WAVE IN A TURBULENT ATMOSPHERE

R. F. Lutomirski and H. T. Yura Jul. 1970 25 p refs
(Contract DAHC15-67-C-0141; ARPA Order 189-1)
(AD-711307; RM-6266-ARPA) Avail: NTIS CSCL 20/6

Part of an overall study of phenomena that affect the performance of optical or infrared reconnaissance and guidance equipment, the present work shows that the most commonly used expression for the mutual coherence function for an optical wave propagating in a turbulent atmosphere is, in general, incorrect. This expression is based on an unphysical extrapolation of the Kolomogorov spectrum. In modifying the spectrum, however, the corrections to the coherence function, the implied resolution, spreading of a finite beam, and the signal-to-noise ratio using heterodyne detection, can be considerable. Approximate expressions for the coherence function, valid over three distinct propagation distance regimes, are derived. The field is shown to have a greater transverse coherence length than that predicted by other researchers, the difference being more pronounced at shorter ranges. Thus, under many conditions, the performance degradation of devices that depend on the above properties is less than previously reported. Author (TAB)

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N71-11141# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Angewandte Kernphysik.

NEW TOTAL NEUTRON CROSS SECTION MEASUREMENT OF URANIUM BETWEEN 0.5 – 4.35 MeV

D. Kopsch, S. Cierjacks, and G. J. Kirouac May 1970 13 p refs
(EURFNR-777; KFK-1199; CN-26/12) Avail: AEC Depository Libraries

The total neutron cross section of natural uranium was measured with the neutron time-of-flight facility at the Karlsruhe Isochronous Cyclotron (KIC). The measurement covers the energy range between 0.5 and 4.35 MeV with a resolution of 0.03 ns/m; this corresponds to an energy resolution between 200 eV at 0.5 MeV and 7.4 keV at 4.35 MeV. In the energy region 1.1 – 4.35 MeV the statistical error was between 1% and 0.5%, below 1.1 MeV the error increases up to 2.7% at 0.5 MeV. An extensive comparison with new available data is given. The existence of fluctuations in the cross section in the lower energy range is investigated. Author (NSA)

N71-11144# Aerospace Corp., El Segundo, Calif. Lab. Operations.

THE ABSORPTION SPECTRUM OF BaI IN THE REGION OF AUTOIONIZATION FROM 2382 TO 1700 ANGSTROM, JULY 1966 – DECEMBER 1969

Robert D. Hudson, Virginia L. Carter, and Paul A. Young 15 Jul. 1970 23 p refs
(Contract F04701-70-C-0059)
(AD-711785; TR-0059(9260-01)-2; SAMSO-TR-70-328) Avail: NTIS CSCL 7/4

The atomic absorption cross section of barium has been measured in the autoionization region at an instrumental bandwidth of 0.075A between 2380 and 2100A and 0.75A between 2100 and 1700A. The cross sections of the absorption features whose half-widths approach the bandwidth of the monochromator have been corrected to eliminate the bandwidth dependence. The observed structure is grouped into series and presented with measured wavelengths and a parameter F. The latter is numerically equal to the oscillator strength of the transition, except when significant perturbations from neighboring lines or the underlying continuum occur. Evidence of the presence of elements in the series 6pns singlet P(1) and triplet P(1) n > 6 is presented. Author (TAB)

N71-11148# Scientific Research Atomic Reactor Inst., Melekess (USSR).

APPLICATION OF THE METHOD OF INTEGRAL TRANSFORMATIONS TO THE SOLUTION OF BOUNDARY PROBLEMS OF THE NEUTRON TRANSPORT THEORY [PRIMENENIE METODA INTEGRALNYKH PREOBRAZOVANII K RESHENIYU GRANICHNYKH ZADACH TEORII PERENOSA NELTRONOV]

Yu. I. Ershov and S. B. Shikhov 1969 39 p refs In RUSSIAN
(SRARI-P-57) Avail: AEC Depository Libraries

A method of solution of the neutron transport integral equation based on the application of integral transformations is considered. Radon and Fourier integral transformations are shown to be a convenient technique for the investigation of the neutron transport equation in arbitrary geometry. The method is illustrated on a cylindrical geometry example. Known Case's method results in plane and spherical geometries are shown to be obtained easily from the general scheme. Moreover, the possibility of taking account of scattering anisotropy in the limits of method is shown by the example of linear dependance of scattering indicatrix on angles. Author (NSA)

N71-11149# United Kingdom Atomic Energy Authority, Risley (England). Universities Research Reactor.

CONSTRUCTION AND PERFORMANCE OF A GLASS NEUTRON GUIDE

J. C. Bates Jan. 1970 21 p refs
(URR-1) Avail: AEC Depository Libraries

A 10 m long glass walled neutron guide with a radius of curvature of 300 m was constructed and tested. The dimensions and curvature were chosen so that neutrons could not reach the exit directly and only those striking the walls at less than their critical angle for total reflection were transmitted. Measurements of the input and output neutron intensities and spectra, and the variation of intensity and wavelength spectrum over the exit aperture confirmed the correct functioning of the guide. Author (NSA)

N71-11179# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.

CORRECTION TO THE VARIATIONAL CALCULATION OF THE GROUND STATE ENERGY H-3

V. N. Maksimenko 1970 10 p refs In RUSSIAN; ENGLISH summary
(ITF-70-25) Avail: AEC Depository Libraries

The correction of the second order of perturbation theory to the variational binding energy of nucleus H-3 conditioned by the difference of the pair interaction potential between nucleons from the effective potential generating the basic wave functions is considered. The general expression for such a correction in the case when the central and tensor forces act between nucleons is obtained. As test functions those of the harmonic oscillator were chosen. The numerical calculations for various potentials of the Gauss shape based on the data of the two-body problem were carried out. Author (NSA)

N71-11397# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.

LIFE-TIME MEASUREMENTS OF 2(+) ROTATIONAL STATES IN Os-182 and Os-184 AND OF THE 1020 keV EXCITED STATE IN Bi-204

R. Broda, J. Golczewski, A. Z. Hrynkiewicz, R. Kulessa, and W. Walus 1970 15 p refs
(JINR-E6-5070) Avail: AEC Depository Libraries

The lifetimes of the 2(+) rotational states in Os-182 and Os-184 and of the 1020 keV excited state in Bi-204 were measured by means of the delayed coincidence method. The systematics of the measured lifetimes of the first 2(+) states in even osmium isotopes Os-182 to 192 are presented. The experimental values of the lifetimes, intrinsic quadrupole moments Q0 and the deformation parameters are compared to the theoretical calculations of Kumar and Baranger. Author (NSA)

N71-11398# California Univ., Livermore. Lawrence Radiation Lab.

BUGGY: SPECIAL CLOUD CONTENT STUDIES

Jerry J. Cohen Apr. 1970 20 p refs Sponsored by AEC
(PNE-330; UCRL-50825) Avail: NTIS

Following the detonation of the Project Buggy explosives on March 12, 1968, the variance of radioactivity concentrations within the effluent cloud and the size distribution of radioactive particulates were measured. Parachute samplers were dropped through the cloud, and ground-based sequential samplers and filter packs were stationed along arcs relative to ground zero. The ground-based sequential sampler data indicated that the bulk of the radioactive material was concentrated toward the leading edge of the cloud and it is estimated that about one quarter of the total radioactivity leaving the crater area departed after the initial cloud was formed. Author (NSA)

N71-11399# Sandia Corp., Albuquerque, N.Mex.

CONCERNING THE DIRECT H-T AND H-D EXCHANGE REACTION IN ALKYL AROMATICS, UTILIZING HYDROGENATION CATALYSTS

M. Baumeister 30 Jul. 1970 4 p Transl. into ENGLISH from the German
(SC-T-70-4031) Avail: NTIS

Activity measurements were made by liquid scintillation spectrometry and radio gas chromatography. The dependence of amount of incorporated tritium on the quantity of utilized catalyst and on the overall supply of tritium was determined. Deuterium distribution in the compounds was measured mass spectrometrically. NSA

N71-11400# Stanford Univ., Calif. High Energy Physics Lab.

MEASURED AND COMPUTED FIELDS IN THE NIOBIUM ACCELERATOR STRUCTURE

Peter Bramham Jul. 1970 37 p refs
(Contract Nonr-225(67); Grant NSF GP-9498)
(AD-712085; SU-HEPL-639) Avail: NTIS CSCL 20/7

The dimensions for the niobium L-band accelerating structure were determined by measurements on copper models. These measurements related the dimensions of cells in the structure to the frequencies and coupling factors in a chain of coupled lumped-circuits. Frequencies and coupling factors were computed for a chain of eight resonant circuits forming a superperiod of structure having the desired characteristics. The superperiod was then made up of copper cells corresponding to a multiperiodic construction module of eight cells. Final machining was carried out on the copper model to give the structure the desired operating frequency and axial field profile. Special cells were developed in the same way to form the ends of an acceleratin structure. This note presents perturbation measurements and field computations relating fields at various points on the axis and on the walls of the structure. Author (TAB)

N71-11411# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.

MECHANISMS OF THE NUCLEAR REACTIONS Be-9(p,p)Be-9 AND Be-9(p,alpha)Li-6 AT LOW ENERGIES [MECANISMES DES REACTIONS NUCLEAIRES Be-9(p,p)Be-9 ET Be-9(p,alpha)Li-6 A BASSE ENERGIE]

A. Bontemps, N. Longequeue, E. Ligeon, and J. F. Cavaignac [1970] 5 p refs In FRENCH Presented at the Colloq. sur les Mecanismes des Reactions Nucl., Grenoble, France, 16–18 Mar. 1970
(CEA-Conf-1499) Avail: AEC Depository Libraries

In order to unify the different results relating to the exited levels of B-10, the reactions Be-9(p,p)Be-9 and Be-9(p,alpha)Li-6 were studied in the energy range 0.8 to 1.5 MeV. NSA

N71-11412# Central Electricity Generating Board, Berkeley (England). Research and Development Dept.

CORRECTIONS TO THE BENOIST DIFFUSION COEFFICIENTS FOR CAGR TYPE LATTICES

M. J. Bridge and N. Howarth Mar. 1970 30 p refs Submitted for publication
(RD/B/N-1645; JNPC/RPWP/N-426) Avail: AEC Depository Libraries

An error was discovered in the Benoist theory of cell diffusion coefficients. It is shown that, in addition, there are some further terms (related to the tilted flux component and neglected in the Benoist formulae) which become important for CAGR type lattices. These theoretical corrections were confirmed in slab geometry by comparison with diffusion coefficients derived on neutron balance grounds from heterogeneous CRAM diffusion theory calculations. A possible scheme for calculating the corrections to Benoist type diffusion coefficients in cylindrical geometry is outlined. A method of obtaining dipole boundary conditions for heterogeneous codes consistent with these diffusion coefficients is given. The use of these dipoles improves the calculation of cross-channel gradients as is shown by a comparison of some results with experiment. Author (NSA)

N71-11460*# Australian National Univ., Canberra. Dept. of Nuclear Physics.

CHARGE OF IONS EMITTING SPECTRAL LINES

G. W. Carriveau and S. Bashkin [1970] 8 p refs Sponsored in part by NASA
(Contract F33615-70-C-1007)
(NASA-CR-111379; ANU-P/495) Avail: NTIS CSCL 20H

A modified technique was applied to the beam foil light source to determine unambiguously and correctly the charge of the ions from which spectral lines are emitted. After transmission through the thin exciter foil, the luminous beam of ions passes through a transverse electric field of up to 80 kV/cm. The field introduces a Doppler shift which depends in magnitude on the charge state of the emitting ion and in sign on the direction of the field. In the spectral range from 1800 A to 8000 A, lines from carbon, nitrogen, and neon were distinguished and assigned to various transition arrays. The technique, unlike those previously used, is readily adaptable to the vacuum ultraviolet. Author

N71-11462*# Australian National Univ., Canberra. Dept. of Nuclear Physics.

CHARGE IDENTIFICATION FOR SPECTRAL LINES IN NITROGEN

S. Bashkin, G. W. Carriveau, and H. J. Hay [1970] 11 p refs
(Grant NGR-03-002-017; Contracts F33615-70-C-1007; N00013-67-A-0209-0005)
(NASA-CF-111380; ANU-P/460) Avail: NTIS CSCL 07D

A modified technique was applied to the beam foil light source to determine unambiguously and correctly the charge of the ions from which spectral lines are emitted. After transmission through the thin exciter foil, the luminous beam of ions passes through a transverse electric field of up to 70 kV/cm. The field introduces a Doppler shift which depends in magnitude on the charge state of the emitting ion and in sign on the direction of the field. In the spectral range of 3300 A to 6000 A, lines in nitrogen were distinguished and assigned to various transition arrays. Author

N71-11463# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Physics.

A SIMPLE MONOCHROMATIC POLARIZED Fe 57 MOSSBAUER SOURCE

John P. Stampfel and Paul A. Flinn 1970 27 p refs Submitted for publication Sponsored in part by AEC and NSF
(Contract N00014-67-A-0314-0005)
(AD-711620; TR-5) Avail: NTIS CSCL 20/8

A polarized Co57 Mossbauer source has been realized by using a source in the form of CoO (I) covered by a ferromagnetic Rhodium-Iron alloy absorber. One of the delta m = 0 lines of the absorber has the same energy as the emitted radiation from the source, and selectively absorbs one of the polarized components of the gamma rays; the other component can be used as a polarized beam in Mossbauer spectroscopy. Author (TAB)

N71-11501# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.

MULTIPOLE ANALYSIS OF THE FAST NUCLEON SCATTERING BY NUCLEI

A. G. Sitenko, I. S. Dotsenko, and A. D. Fursa 1970 30 p refs In RUSSIAN
(ITF-70-18) Avail: AEC Depository Libraries

To describe the high-energy nucleon scattering on nuclei a multipole formalism is developed. The impulse approximation is used. The cross section of nucleon scattering on nuclei is expressed through the nucleon−nucleon scattering and the form factors connected with the nuclear structure. Taking into account the charge freedom degrees of nucleons, nuclei can be described by multipoles of sixteen types. To each transition of the definite multipolarity there correspond selection rules. As an example the numerical calculations of angular distributions for elastic proton scattering on nuclei C-12 as well as for inelastic proton scattering with excitation of levels 2(+), 3(−) and 1(+) for T = 0 and 1(+) for T = 1 of nucleus C-12 are carried out. Author (NSA)

N71-11742# Iowa State Univ. of Science and Technology, Ames. Ames Lab.

INSTRUMENTAL ACTIVATION ANALYSIS OF RARE EARTH MIXTURES

Duane Ernest Becknell (Ph. D. Thesis) May 1970 112 p refs
(Contract W-7405-eng-82)
(IS-T-360) Avail: NTIS

A nondestructive instrumental activation analysis method was developed for the determination of the composition of heavy (Sm − Lu) rare earth mixtures. The method employs two irradiations of the same set of samples, the first being in epithermal neutrons for the analysis of all rare earths except Dy which is subsequently analyzed by thermal neutron reirradiation. Data collection could be completed in as little as 48 hours from the time of the initial irradiation. The procedure developed requires no preirradiation wet chemistry or postirradiation separation of the elements. It was applied to mixtures of one-to-one composition with the exception of Eu which was present at one-tenth the amount of the other rare earths. In addition, samples of a simulation of gadolinite, a heavy rare earth ore, were analyzed. The results were within + or − 4 percent of the actual values in the poorest case while errors of + or − 2 percent were more common. Author (NSA)

N71-11743# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.

CHARACTERISTICS OF X-RAY TRANSITION RADIATION PRODUCED BY A SUPERFAST PARTICLE IN A STACK OF PLATES

G. M. Garibyan Oct. 1970 46 p refs Transl. into ENGLISH from Russian report
(TR-58) Avail: NTIS

A detailed theoretical analysis is performed for the generation process of transition radiation in the transoptical frequency domain during the transit of a highly relativistic particle through a stack of plates. It is shown that such radiation can be described in terms of various formulas as a function of concrete physical conditions. Also presented are some results of numerical calculations of the spectral distributions of the number of quanta of the transition radiation, and the question of the possibility of the influence of multiple scattering on such distributions is briefly considered. Author

N71-11744# Minnesota Univ., Minneapolis. Molecular Spectroscopy Lab.

A STUDY OF FUNDAMENTAL MOLECULAR PARAMETERS CONTROLLING VIBRATIONAL INTENSITIES Final Report, 15 Sep. 1965 – 15 Mar. 1970

Bryce L. Crawford, Jr. and John Overend 1970 5 p refs
(Contract DA-31-124-ARO(D)-415)
(AD-711580; AROD-3565-11-C) Avail: NTIS CSCL 7/4

The report briefly summarizes the results of a study of fundamental molecular parameters controlling vibrational intensities both from an experimental and theoretical viewpoint. In addition, nine publications are listed which treat individual aspects of the research. Author (TAB)

N71-11746# Princeton Univ., N.J. Dept. of Physics.

A WIRE-SPARK-CHAMBER SYSTEM WITH ON-LINE COMPUTERS

W. T. Ford, P. A. Piroue, R. S. Remmel, A. J. S. Smith, and P. A. Souder 27 May 1970 14 p refs Presented at the 10th Intern. Conf. on Data Handling Systems in High Energy Phys., Cambridge
(PURC-2137-22; CONF-700323-1; TR-7) Avail: NTIS

The performance of a system of wire spark chambers and 2 on-line computers (one being time-shared) used in an experiment to study the decay of kaon (+ or −) mesons via the tau mode (kaon(+ or −) yields pion(+ or −) pion(+ or −) pion(− or +)) is described. Author (NSA)

N71-11747# Hamburg Univ. (West Germany). Zweites Inst. fuer Experimentalphysik.

MEASUREMENT OF ELASTIC NEUTRON SCATTERING BY NITROGEN 15, IN PARTICULAR OF THE 1(−) AND 2(−)

STATES OF 1 p1/2(−1) 1 d3/2(1), AND COMPARISON WITH CALCULATIONS BY WEIDENMUELLER [MESSUNG DER ELASTISCHEN NEUTRONENSTREUUNG AN STICKSTOFF 15, INSBESONDERE DER [(p1/2(−1) 1 d3/2(1)]-1(−),2(−)-ZUSTAENDE, UND VERGLEICH MIT RECHNUNGEN NACH WEIDENMUELLER]
Rudolf Putzki (Ph.D. Thesis) 1969 50 p refs In GERMAN
Avail: NTIS

The elastic neutron scattering reaction N-15(n,n) was measured in order to complete the existing data on cross sections by means of a time of flight spectrometer. The coefficients of the Legendre polynomials were calculated. Shell theoretical calculations are compared with the experimental results. ESRO

N71-11748# Hamburg Univ. (West Germany). Zweites Inst. fuer Experimentalphysik.
MEASUREMENT OF LIFE TIME AND MAGNETIC MOMENT OF 5/2(−) STATE IN Ge-71 AFTER THE NUCLEAR REACTION Ga-71(p,n)Ge-71 AND DISCUSSION OF THE 5/2(−) STATES OF MEDIUM WEIGHT EVEN/ODD NUCLEI IN THE SHELL MODEL WITH RESIDUAL INTERACTION [MESSUNG VON LEBENSDAUER UND MAGNETISCHEM MOMENT DES 5/2(−)-ZUSTANDES IM Ge-71 NACH DER KERNREAKTION Ga-71(p,n) Ge-71 UND DISKUSSION DER 5/2(−)-ZUSTAENDE MITTELSCHWERER g-u-KERNE IM SCHALENMODELL MIT RESTWECHSELWIRKUNG]
Joachim Schmidt (Ph.D. Thesis) 1969 73 p refs In GERMAN
Avail: NTIS

The lifetime of the first excited level in germanium 71 was measured and the magnetic moment of this state was determined from the differential observation of the spin rotation. The particle-gamma ray correlation function for the reaction used, Ga-71(p,n)Ge-71, was calculated in the statistical model. The results were discussed in view of the applicability of the shell model to nuclei around A = 70. It is concluded that no stable deformations exist in the nuclei of this range. ESRO

N71-11749# West Virginia Univ., Morgantown. Coll. of Engineering.
PROCEEDINGS OF THE CONFERENCE ON UTILIZATION OF NUCLEAR TECHNOLOGY IN INDUSTRIAL OPERATIONS
Raymond E. Shafer, ed. Aug. 1970 114 p refs Conf. held at Charleston, W. Va., 8−9 Jun. 1970; sponsored in part by West Va. Tech. Serv., West Va. Univ. Appalachian Center, and Southern Interstate Nucl. Board *Its* West Va. Univ. Bull. Ser. 71, No. 2-1
(PB-193582) Avail: NTIS CSCL 18B

Contents: Principles of Nuclear Radiation Measurements and Detection Instruments; Examples of Nuclear Application Research; An Introduction to Neutron Radiography; Radioisotope Applications in Oil Well Surveying; Applications of Radiation to Industrial Processing and Process Control; The Status of Process Radiation in the United States; The AEC Licensing Program; Radioactive Material Inspection Program; Radiation Safety. USGRDR

N71-11750# Hamburg Univ. (West Germany). Zweites Physikalisches Inst.
INVESTIGATION OF THE TWO LOWEST ROTATIONAL BANDS AND OF THE GROUND STATE OF OXYGEN 16 BY NUCLEAR RESONANCE FLUORESCENCE IN THE 6.92 MeV(2+) AND 7.12 MeV(1−) LEVELS [UNTERSUCHUNG DER BEIDEN NIEDRIGSTEN ROTATIONSBANDEN UND DES GRUNDZUSTANDES VON O-16 DURCH KERNRESONANZFLUORESZENZ AN DEN 6.92 MeV(2+)-UND 7.12 MeV(1−)-NIVEAUS]
Guenter Fluegge (Ph.D Thesis) 1969 61 p refs In GERMAN
Avail: NTIS

A nuclear resonance fluorescence scattering experiment on oxygen 16 was conducted using Ge(Li) detectors to improve the separation of two neighboring levels. The errors were reduced by measuring simultaneously the source and effect spectra. The transitions involved (E2 and E1) could be determined more accurately. The experimental results were compared with theoretical considerations. ESRO

N71-11771# Oak Ridge National Lab., Tenn. Physics Div.
COMPREHENSIVE CALCULATION OF IONIZATION POTENTIALS AND BINDING ENERGIES FOR MULTIPLY-CHARGED IONS
Thomas A. Carlson, C. W. Nestor, Jr., Neil Wasserman, and J. D. McDowell Jul. 1970 43 p refs
(Contract W-7405-eng-26)
(ORNL-4562) Avail: NTIS

Ionization potentials were calculated for all the elements up to Z = 103 for all states of ionization. The calculations are based on a simple spherical shell model using eigenvalues and mean radii from Hartree−Fock solutions for neutral atoms. The average deviation of the calculated ionization potentials from experimental values was found to be within 5%. A simple method was developed for estimating the binding energies in all shells of a multiply charged ion from the calculated ionization potentials. Author (NSA)

N71-11772# Pittsburgh Univ., Pa. Dept. of Physics.
EXACT SCREENED CALCULATIONS OF ATOMIC FIELD BREMSSTRAHLUNG
H. K. Tseng and R. H. Pratt May 1970 68 p refs
(Contract AT(30-1)-3829)
(NYO-3829-51) Avail: NTIS

A discussion of relativistic bremsstrahlung cross sections is given for incident electron kinetic energies in the range 5 keV to 1 MeV, based on an exact numerical calculation in screened potentials. Comparisons are made with previous authors (extending the discussion of a preliminary note) and with experiment. Exact point Coulomb and Born approximation results are contrasted. Results show that the Born approximation significantly underestimates the bremsstrahlung cross sections in the energy region considered. Screening effects are somewhat larger than expected and when large are not well described by a form factor. Author (NSA)

N71-11785# Rome Univ. (Italy). Inst. of Physics.
LOWER BOUND TO THE MAGNITUDE OF THE NUCLEAR BINDING ENERGIES OF DOUBLY MAGIC NUCLEI. PART 2: VELOCITY-DEPENDENT FORCES
F. Calogero and Y. A. Simonov (Inst. of Theoret. and Exptl. Phys., Moscow) 29 Jan. 1970 57 p refs For Part 1 see N70-13767 03-24 *Its* Nota Interna No. 254
Avail: NTIS

The velocity dependence of nucleon-nucleon potentials for doubly magic nuclei is investigated based on the two-body problem. A test of these potentials in the many-body context of nuclear physics is reported. ESRO

N71-11786*# Oak Ridge National Lab., Tenn. Nuetron Physics Div.
CALCULATION OF THE NEUTRON SPECTRA FROM PROTON-NUCLEUS NONELASTIC COLLISIONS IN THE ENERGY RANGE 15−18 MeV AND COMPARISON WITH EXPERIMENT
R. G. Alsmiller, Jr. and O. W. Hermann 15 Sep. 1969 24 p refs Submitted for publication Sponsored in part by AEC
(NASA Order H-3828A)
(NASA-CR-111411; ORNL-TM-2752) Avail: NTIS CSCL 08H

The energy distributions of neutrons from proton-nucleus nonelastic collisions fo 18-MeV protons on N-14, Al-27, Fe-56, Ta-181, and Pb-208 and for 15-MeV protons on Al-27 and Pb-208 were calculated with the intranuclear-cascade-evaporation model of nuclear reactions and with the evaporation model of nuclear reactions. Comparisons between the calculated neutron spectra and experimental data are presented, and it is shown that neither model is entirely reliable in the energy region considered but that the intranuclear-cascade-evaporation model is the move reliable of the two Author (USGRDR)

N71-11787# International Centre for Theoretical Physics, Trieste (Italy).
LOW-ENERGY ELECTROPRODUCTION AND EQUAL-TIME COMMUTATORS
G. Furlan, N. Paver (Trieste Univ)., and C. Verzegnassi (Trieste Univ.) Apr. 1970 33 p refs Submitted for publication Sponsored in part by Ist. Nazl. di Fis. Nucl.
(IC/70/27) Avail: NTIS

Low-energy photoproduction and electroproduction of pions are estimated, using equal-time commutators between current densities and divergences and including low-lying intermediate states. Predictions are presented for charged photoproduction s- and p-wave multipoles, in agreement with experiments and dispersion theory, and for transversal and longitudinal electroproduction cross-sections near threshold. The dependence of the results on the axial vector form factor G sub A (t) is discussed. Author (ESRO)

N71-11788# California Univ., Santa Barbara. Dept. of Chemistry.
THE EFFECTS OF PRESSURE AND TEMPERATURE ON THE ELECTRONIC PROPERTIES OF MATERIALS Final Technical Report
Henry W. Offen 2 Sep. 1970 44 p refs
(Contracts N00014-66-C-0019A-01; N00014-67-A-0120-0001; N00014-69-A-0200-8002)
(AD-711615) Avail: NTIS CSCL 7/4

The report summarizes the authors research. The report is divided into three sections which represent the main thrust of the research program in high-pressure spectroscopy. The first section concerns the experimental techniques developed under the contract. The next two sections deal with environmental perturbations on molecular complexes which are stable in the ground state (Electron-Donor-Acceptor Complexes) or possess strong binding only in the excited state (Excimer). The final section concerns the fate of the triplet energy and triplet kinetics in environments under extreme pressure conditions and at different temperatures. Author (TAB)

N71-11789# International Centre for Theoretical Physics, Trieste (Italy).
QUANTUM GRAVITY AND INFINITIES IN QUANTUM ELECTRODYNAMICS
Abdus Salam and J. Strathdee May 1970 14 p refs Submitted for publication
(IC/70/38) Avail: NTIS

A discussion of quantum gravity and infinities in quantum electrodynamics is presented. Using Einstein's non-polynomial modification of electrodynamics, with quantum gravitational effects taken into account, it is shown that the self-mass and self-charge infinities of lepton electrondynamics disappear in a non-perturbative treatment of gravity. A simplified treatment of the infinity-suppression mechanism is described. Author (ESRO)

N71-11790# Naval Research Lab., Washington, D.C. Linac Branch.
REPORT OF LINAC OPERATION Interim Report, 1 Jan. – 30 Jun. 1970
T. F. Godlove, ed. Aug. 1970 29 p refs
(AD-711587; NRL-MR-2158; IR-10) Avail: NTIS CSCL 20/7

The operation and use of the NRL 60-MeV Electron Linear Accelerator is described for the period 1 January - 30 June 1970. Progress on the research program is discussed, including 180 degrees electron scattering on H and He isotopes, photonuclear excitation studies of 11B and 13C, and neutron resonance spin determinations for isotopes. Installation of various interface electronics completes a computer data acquisition system, insofar as the neutron time-of-flight experiments are concerned, and preliminary data with the system has been taken. Total manned time for the period was 1955 hours, divided into 1320 hours for beam and set-up time (including 83 hours for outside users), 612 hours devoted to maintenance and improvements, and 23 hours lost to breakdowns, a record low that will be difficult to beat. References are included, as are brief descriptions of the use of the linac by other groups. Author (TAB)

N71-11791# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
PRODUCTION OF DISPLACEMENT DAMAGE BY LIGHT IONS
R. T. King Jul. 1970 26 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3013) Avail: NTIS

The rates at which atoms are displaced from normal lattice positions by protons and alpha particles are calculated as functions of ion energy for aluminum, copper, stainless steel, and molybdenum. Ion-bombardment experiments cannot completely simulate neutron irradiations. Light-ion bombardment experiments are useful for screening alloys by electron microscopy for irradiation stability. Author (NSA)

N71-11792# Hamburg Univ. (West Germany). Zweites Inst. fuer Experimentalphysik.
INVESTIGATION OF THE ELASTIC SCATTERING N-15(n,n) N-15 AND COMPARISON WITH CALCULATIONS BY THE METHOD OF COUPLED CHANNELS [UNTERSUCHUNG DER ELASTISCHEN STREUUNG N-15(n,n) N-15 UND VERGLEICH MIT RECHNUNGEN NACH DER METHODE DER GEKOPPELTEN KANAELE]
Hans-Heino Dubenkropp (Ph.D. Thesis) 1969 62 p refs In GERMAN
Avail: NTIS

The angular distribution of neutrons scattered by nitrogen 15 nuclei was measured using a time of flight spectrometer. The total cross section, the excitation functions, the angular distribution, and the polarization were measured. The experimental results were analyzed and interpreted and it appeared to be possible to describe the reaction under consideration by means of the shell model using the method of coupled channels. ESRO

N71-11793# International Centre for Theoretical Physics, Trieste (Italy).
NON-PARALLEL DAUGHTERS AND PION PION SCATTERING
L. A. Copley and J. C. Eilbeck May 1970 12 p refs Submitted for publication Sponsored in part by Roy. Soc. London and Can. Natl. Res. Council
(IC/70/30) Avail: NTIS

It is investigated whether the rho Regge trajectory and its first daughter trajectory are not parallel. A model with non-parallel daughter trajectories is constructed using a modified version of the Kazes-Wang interference model. The hypothesis of non-parallelism is found to be consistent with low-energy pion pion data. Author (ESRO)

N71-11794# ARO, Inc., Arnold Air Force Station, Tenn.
EXPERIMENTAL INVESTIGATION OF THE SCATTERING OF A NITROGEN AERODYNAMIC MOLECULAR BEAM FROM A SOLID NITROGEN SURFACS Final Technical Report, Dec. 1969 – Jan. 1970
Frederick Arnold, M. R. Busby, and Ronald Dawbarn AEDC Oct. 1970 54 p refs
(Contract F40600-71-C-0002)
(AD-712374; AEDC-TR-70-172; ARO-VKF-TR-70-172) Avail: NTIS CSCL 7/4

An aerodynamic molecular beam and phase sensitive detection system were used to investigate the spatial distributions of nitrogen molecules scattered from solid nitrogen for (1) incident beam energies of 0.44 ev (source stagnation temperature (T(o)) = 1440K) to 0.88 ev (T(o) = 2760K), (2) incident angles (with respect to surface normal) of 30 to 70 deg, and (3) a surface temperature of 23K. Highly lobular reflected distributions centered 15 deg from the surface opposite the incident beam were observed with position and shape independent of incident energy and angle. The capture coefficient decreased sharply with increasing beam energy and incident angle from normal. A limited investigation of a nitrogen-argon mixture was also undertaken. The reflected spatial distributions for the components were similar to those observed for the individual pure gases. A seeding effect in the expansion was observed to accelerate the heavier gas. Transient effects were also investigated. Author (TAB)

N71-11795# ARO, Inc., Arnold Air Force Station, Tenn.

EXPERIMENTAL INVESTIGATION OF THE SCATTERING OF A MONOENERGETIC ARGON MOLECULAR BEAM FROM A SOLID ARGON SURFACE Final Report, Nov.–Dec. 1969

M. R. Busby and R. F. Brown AEDC Oct. 1970 60 p refs
(Contract F40600-71-C-0002)
(AD-712015; AEDC-TR-70-90; ARO-VKF-TR-70-90) Avail: NTIS CSCL 7/4

An aerodynamic molecular beam and phase sensitive detection system were used T(o) investigate the spatial distributions of argon atoms scattered from solid argon for: incident beam energies of 0.3 (To = 1400K), 0.37 (1700K), 0.43 (2000K), and 0.5 ev (2300K); incident angles (measured with respect to the surface normal) of 0 to 70 deg; and solid argon temperatures of 13.5K. The effect of surface temperature on the distributions for 0.5-ev beams at 70-deg incidence was studied in the range from 13.5 to 23K. Both in-plane and out-of-plane spatial distribution measurements were made, and highly nondiffuse supraspecular flux distributions were observed for the noncondensing atoms. The experimental data indicated that the angle of maximum reflected intensity was independent of the beam intensities, beam energies, beam incidence angles, and surface temperatures investigated; and its value was approximately 75 deg. The beam capture coefficient was a monotonically decreasing function as the angle of incidence and the incident beam energy increased. Author (TAB)

N71-11831# State Univ. of New York, Binghamton. Dept. of Physics.

AXIAL-VECTOR MESON DOMINANCE AND A NEW ESTIMATE FOR THE DECAY KAON (+) YIELDS PION(+) GAMMA GAMMA

Gerald W. Intemann [1970] 17 p refs
Avail: NTIS

The radiative decay mode positive kaon yields positive pion photon photon is studied within the framework of an axial-vector dominance model (AVDM) with the exchange of the A(+) sub 1(1070), B(+)(1235) and K(+)sub a(1320) dominating the decay. Obtained is a new estimate for the branching ratio depending on the d-wave to s-wave ratio in axial-vector meson decays. For a modest amount of d-wave the AVDM result is comparable to the value for R based on the neutral pion-pole model and is also in good agreement with the experiment. The energy spectrum is also calculated using AVDM and compared to the spectrum found in the neutral pion-pole model. The significance of these results to the testing of a proposed mechanism for positive kaon yields positive pion neutral pion is also discussed. Author

N71-11832# State Univ. of New York, Binghamton. Dept. of Physics.

CURRENT ALGEBRA, VECTOR DOMINANCE AND THE DECAY NEUTRAL KAON SUB L YIELDS PION(+) PION(−) PION(0) GAMMA

Gerald W. Intemann [1970] 20 p refs
Avail: NTIS

Calculated is the decay rate and photon energy spectrum for the decay mode neutral kaon sub L yields positive pion negative pion neutral pion photon. Neglecting small CP-violating effects, the EL amplitude is related to the amplitude for neutral kaon sub L yields neutral pion photon photon using current algebra and the hypothesis of a partially conserved axial vector current. The branching ratio is found to be ≈ 0.16%. Also determined is the same branching ratio based on the rho-dominance model and good agreement with the corresponding results of current algebra is found. Author

N71-11854# Army Foreign Science and Technology Center, Washington, D.C.

MONTE CARLO COMPUTATION OF VOLUME EFFECTS IN MACROMOLECULES FOR CHAINS IN A CUBIC LATTICE [RASCHET OBEMNYKH EFFEKTOV V MAKROMOLEKULAKH METODOM MONTE-KARLO DLYA TSEPEI NA KUBICHESKOI RESKETKE]

A. M. Elyashevich et al 18 Sep. 1970 15 p refs Transl. into ENGLISH from Vysokomolekul. Soedin., Ser. A (Moscow), v. 11, no. 9, 1969 p 1875–1880
(AD-712339; FSTC-HT-23-905-70) Avail: NTIS CSCL 7/4

A method is proposed for the comparative evaluation of the flexibility and excluded volume parameters in chains of different types from data on the dependence of (h sq) on the number of links in a chain. The method is not dependent on any specific theory of volume effects and is based solely on the assumption of a universal dependence of alpha on Z. The parameters determined by this method agree with direct computations, thereby confirming the existence of such a universal dependence. Author (TAB)

N71-11855# Oak Ridge National Lab., Tenn.

THE MORSE CODE: A MULTIGROUP NEUTRON AND GAMMA-RAY MONTE CARLO TRANSPORT CODE

E. A. Straker, P. N. Stevens, D. C. Irving, and V. R. Cain Sep. 1970 315 p refs
(AD-711941; ORNL-4585) Avail: NTIS CSCL 9/2

The MORSE code is a multipurpose neutron and gamma-ray transport Monte Carlo code. Through the use of multigroup cross sections, the solution of neutron, gamma-ray, or coupled neutron-gamma-ray problems may be obtained in either the forward or adjoint mode. Time dependence for both shielding and criticality problems is provided. General three-dimensional geometry, as well as specialized one-dimensional geometry descriptions, may be used with an albedo option available at any material surface. A detailed discussion of the relationship between forward and adjoint flux and collision densities, as well as a detailed description of the treatment of the angle of scattering, is given in the appendices. Logical flow charts for each subroutine add to the understanding of the code. Author (TAB)

N71-11857# North Carolina Univ., Chapel Hill. Dept. of Physics.

COVARIANT QUANTUM GEOMETRODYNAMICS

Bryce S. DeWitt [1970] 59 p refs Sponsored in part by NSF
Avail: Issuing Activity

An attempt is made to explain the complexity of covariant quantization schemes in heuristic and nonrigorous terms. The complexity is considered to arise from two sources: covariant formalisms are designed for almost direct application to specific problems, and quantum geometrodynamics satisfies simultaneously several distinct invariance properties of fundamental importance. A notation is chosen which emphasizes the important relationships. The Feynman functional integral, the measure functional, gauge choice, tree theorems, and modified functional integral are discussed. The most serious problem area, stated to be the foundation of covariant formalism in scattering theory, and other difficulties are described. N.E.N.

N71-11858# Stanford Linear Accelerator Center, Calif.
PERFORMANCE OF THE SLAC SPIRAL READER
J. S. Loos and D. W. G. S. Leith Jun. 1970 10 p refs
Presented at Intern. Conf. on Instrumentation for High Energy Phys., Dubna, USSR, 8 – 12 Sep. 1970 Sponsored by AEC
(SLAC-PUB-765) Avail: NTIS

The general performance of the SLAC spiral reader is presented. The following topics are discussed: (1) detailed comparisons to measurements on conventional machines in terms of physics output and measurement accuracy; (2) an evaluation of peak and averaged measuring rates; and (3) a brief description of hardware development work in progress. Author (NSA)

N71-11906# Rome Univ. (Italy). Inst. of Physics.
ON THE QUADRUPOLE FORCE IN NUCLEAR SPECTROSCOPY
E. Olivieri and E. Salusti 19 Dec. 1969 21 p refs *Its* Nota Interna No. 248
Avail: NTIS

The shell model of deformed nuclei with spherically symmetric potential is not able to explain some experimental features, like large quadrupole moments and rapid electromagnetic transitions. In accepting the idea of a central spherical potential, the utility of applying a calculation procedure to the deformed nuclei related to an iterative method (Jean or Klein theory), which gives interesting results in the study of the spherical nuclei, is suggested. ESRO

N71-11909# International Centre for Theoretical Physics, Trieste (Italy).
REGULARIZATION OF QUANTUM ELECTRODYNAMICS THROUGH NON-POLYNOMIAL LAGRANGIANS
P. Budini and G. Calucci (Trieste Univ.) May 1970 32 p refs
Submitted for publication
(IC/70/37) Avail: NTIS

A model for regularizing quantum electrodynamics through a non-polynomial Lagrangian describing the interaction of the electron field with an auxiliary field is given. A gauge invariant Lagrangian density is obtained. This kind of regularization avoids the difficulties connected with indefinite metric. Renormalization of quantum electrodynamics is performed for irreducible diagrams, and the physical implications are discussed. Author (ESRO)

N71-11910# Oak Ridge National Lab., Tenn.
ORNL DECENTRALIZED NUCLEAR SCIENCE ABSTRACTS PREPARATION Semiannual Report, Period Ending 1 Jul. 1969
Charles A. Horton 22 Oct. 1969 87 p refs Supported by AEC
(PB-190501; ORNL-TM-2653; SAR-1) Avail: NTIS CSCL 05B

The decentralized preparation of abstracts for Nuclear Science Abstracts (NSA), along with NSA indices and indices for the EURATOM and possible International Nuclear Information System (INIS) at the International Atomic Energy Agency information retrieval systems, was compared with centralized preparation of the same material by the regular staff of NSA at the Atomic Energy Division of Technical Information Extension in Oak Ridge (DTIE). All full release unclassified reports in all fields issued over a period of several months at ORNL were abstracted and indexed by a minimally trained ORNL scientist. The results show that the items are prepared about two weeks sooner by ORNL on-site than at DTIE. The time required to complete an average shorter report set of indices at ORNL is about one hour, as compared to 0.7 hours at DTIE for all types of items. Parts of long progres reports, however, required 2.5 hours/part at ORNL. The ORNL cost per item is considerably higher, mainly due to overhead charges. About 50% of the total DTIE index terms for both NSA subject entries and EURATOM Keywords were also used in the ORNL indices. Author (USGRDR)

N71-11913# McElroy (Ralph) Co., Austin, Tex. Custom Div.
ENERGY STORAGE IN A SUPERCONDUCTING WINDING [STOCKAGE D'ENERGIE DANS UN ENROULEMENT SUPRACONDUCTEUR]
M. Ferrier [1969] 11 p refs Transl. into ENGLISH from Bull. Inst. Int. Froid, Annexe (France), no. 1, 1969 p 425 – 432
Sponsored in part by AEC Prepared for Los Alamos Scientific Lab.
(LA-tr-70-9) Avail: NTIS

The problems of energy storage on the scale of the fluctuations of the national or regional load, i.e., of the order of 1,000 MWh are examined. Various configurations are reviewed, and the short solenoid of circular cross section is selected as being economically the most favorable. The field produced and the distribution of the mechanical constraints are discussed for this configuration. An examination of the various losses (at the surface of the cryostat, by mechanical or magnetic hysteresis) shows that they are acceptable. The circulation of the cryogenic fluid is discussed in detail, and it is shown that the ratio of stabilizing material to superconducting material can be reduced to 10:1. Finally, the modes of connecting the storage device to the grid are examined and there is a discussion of the optimum size of the installation as a function of the financial benefits that can be attributed to the different services provided by the device. Author (NSA)

N71-11914# Columbia Univ., New York. Radiation Lab.
RESEARCH INVESTIGATION DIRECTED TOWARD EXTENDING THE USEFUL RANGE OF THE ELECTROMAGNETIC SPECTRUM Progress Report, 1 Sep. 1969 – 30 Jun. 1970
Sven R. Hartmann 30 Jun. 1970 83 p refs
(Contract DAAB07-69-C-0383)
(AD-711646; CU-6-70-C-0383; PR-20) Avail: NTIS CSCL 7/4

New measurements of a number of basic atomic properties have been obtained. These include gF values for the autoionizing quartet states of rubidium, lifetimes of the autoionizing quartet states of helium, and the hyperfine constants and lifetimes of excited P states of lithium. Preliminary phases of an experiment to study electron excitation of atoms by a coincidence technique have been successfully tested. Work in molecular spectroscopy has been expanded. An optically pumped Rb85 maser is now within 1 dB of oscillation on the field-independent 3035.73... MHz transition. Photon-echo amplitudes in ruby have been measured as a function of excitation pulse separation, and the preliminary results are in agreement with theory. The Raman echo apparatus has been improved by the construction of a ceramic heat-pipe oven to contain the T1 vapor and the installation of a 300 MW laser. TAB

N71-11915# Iowa State Univ. of Science and Technology, Ames.
NUCLEAR MAGNETIC RESONANCE HYPERFINE FIELDS IN THE HEXAGONAL LAVES PHASE COMPOUNDS ScMn2, ErMn2, AND TmMn2
Barbara Kegerreis Lunde (Ph.D.Thesis) May 1970 58 p refs
(Contract W-7405-eng-82)
(IS-T-369) Avail: NTIS

The effect of magnetic rare earth ions on the hyperfine fields in intermetallic compounds with manganese was investigated by comparing the measured hyperfine fields in the asymmetric hexagonal Laves phase compounds ErMn2 and TmMn2 with the hyperfine fields in ScMn2 which is very similar, but does not have the incomplete 4f shell of the rare earths. The fields were measured from 4 K to room temperature. The spectra were very interesting because there are two inequivalent sites for Mn, one of which is completely asymmetric, and the compounds are very well ordered. In the ScMn2 spectrum alone, there were 21 detectable lines. The manganese nuclei are electronically isolated from the rare earth ions. The hyperfine fields at the mangangese nuclei remain constant with variation in temperature in all three compounds investigated, even though the magnetic ions become more aligned with the magnetic field at lower temperautre, as predicted by the Curie law and verified by measurement of the magnetic susceptibility. Author (NSA)

N71-11916# International Centre for Theoretical Physics, Trieste (Italy).

SEARCH FOR QUANTUM SYSTEMS WITH A GIVEN SPECTRUM-GENERATING ALGEBRA: DETAILED STUDY OF THE CASE OF SO(2,1)

P. Cordero and G. C. Ghirardi (Trieste Univ.) Apr. 1970 37 p refs Submitted for publication Sponsored in part by Comm. Nacl. de Invest., Chile and Ist. Nazl. di Fis. Nucl.
(IC/70/26) Avail: NTIS

A general method is introduced to determine the Hamiltonians of the quantum mechanical systems having a given Lie algebra as their spectrum-generating algebra. ESRO

N71-11941# Los Alamos Scientific Lab., N.Mex.

RELATIVISTIC CALCULATION OF ANOMALOUS SCATTERING FACTORS FOR X RAYS

Don T. Cromer and David Liberman July 1970 163 p refs
(Contract W-7405-eng-36)
(LA-4403) Avail: NTIS

Anomalous scattering factors, Delta f prime and Delta f doubleprime, were calculated relativistically for chromium, iron, copper, molybdenum, and silver K alpha radiations for the atoms lithium through californium. Relativistic calculations of the photoelectric cross section were made, and, in contrast to previous calculations, the integral for the principal contribution to Delta f prime was evaluated numerically without approximation to the form of the cross-section vs energy curve. Many of the results differ significantly from previous calculations. Where experimental values exist, agreement for Delta f prime is improved. For the rare gases, except for xenon, agreement between Delta f prime and experiment is also improved. Because of the more rigorous evaluation of Delta f prime from cross-section information, it is presumed that the present Delta f prime values are more accurate than those previously calculated. Calculated mass absorption coefficients for the elements are included as incidental information. A FORTRAN program for interpolating cross sections and computing the dispersion at other wavelengths is also given. Author (NSA)

N71-11959# New South Wales Univ., Kensington (Australia).

THERMAL NEUTRON WAVE PROPAGATION IN BERYLLIUM OXIDE

Stewart Whittlestone (M.S. Thesis) 1968 90 p refs
Avail: NTIS

The development of a system to determine the spatial dependence of the amplitudes and phases of thermal neutron waves generated at one face of a cube of beryllium oxide moderator is considered. Errors in attenuation coefficient resulting from neglect of spatial modes and also statistical error on wave amplitude are estimated using one velocity diffusion theory. A computation with the DSN code is used to determine the change of the energy spectrum of neutrons in the moderator when the source neutrons have an energy of about 5 MeV. A servosystem is developed to modulate the accelerator beam sinusoidally along with the design of a charged particle target and an energy stabilization unit for the accelerator. A study of various moderator and charged particle target materials to obtain the best thermal neutron source is included. In addition, the neutron wave detection system is described, the main novelty being the use of a preamplifier gating system to eliminate the effects of amplifier gain drift. Deviations of the experiment from one velocity diffusion theory, similar to the deviations observed for graphite are noted. E.M.C.

N71-11995# Illinois Univ., Urbana. Dept. of Physics.

QUANTUM ELECTRODYNAMICS MULTIPERIPHERAL MODEL AT INFINITE MOMENTUM

W. J. Pardee [1970] 49 p refs
(Grant NSF GP-19433)
Avail: Issuing Activity

The scattering amplitude for the production of an arbitrary number of electron-positron pairs is calculated in a multiperipheral quantum electrodynamic model at infinite momentum. When electron and photon masses are neglected, it is possible to obtain a simple form for the partial cross sections. The leading s dependence obtained from direct calculation is in minor disagreement with that found by Cheng and Wu. The number distribution P(n), the average number of pairs produced, the two particle and one particle momentum distributions, and the total cross section are obtained. The two particle distribution is expressed in terms of the invariant mass, total longitudinal momentum, and transverse momenta of the pair. The contribution of these processes to the absorptive part of the elastic amplitude is studied for small t. The infinite energy result is a fixed cut in the complex angular momentum plane. Author

N71-11996# Utah Univ., Salt Lake City. Dept. of Physics.

EFFECT OF DIFFUSION MECHANISM ON THE SPIN-LATTICE RELAXATION TIME IN A ROTATING FRAME

David C. Ailion and Gary L. Samuelson [1970] 11 p refs Submitted for publication
(Grant NSF GP-17412)
Avail: Issuing Activity

A method for using pulse NMR to distinguish between different diffusion mechanisms is described. These ideas for Cl vacancy diffusion in TlCl by direct observations of the Cl-35 resonance were verified. An activation energy for Cl diffusion of 0.733 + or − 0.012 eV was measured. Author

N71-11997# Gosudarstvenni Komitet po Ispolzovaniyu Atomnoi Energi, Moscow (USSR). Inst. Atomnoi Energii.

THE THEORY OF CHANNELLING EFFECT, 1

Yu. Kagan and Yu. V. Kononets 1969 32 p refs In RUSSIAN; ENGLISH summary
(IAE-1878) Avail: AEC Depository Libraries

A method for considering the channeling effect and related phenomena, based on the use of the density matrix formalism and allowing one to single out the coherent differaction induced by regularity of the medium, is developed. In the case of plane channeling with disregarded inelastic scattering, the problem is reduced to that of the particle motion in the one dimensional periodic potential Veff(x) depending on the crystal temperature. The essential role of states, the energies of which are close to the maximum values of Veff(x), is revealed. The question of the distance, at which the essential change of the nuclear reaction yield occurs, is analyzed. The possibility of appearance of splashes in the nuclear reaction yield with the crystal thickness is shown (a peculiar echo). The concrete analysis was carried out for the model potential of the Kronig–Penney type. The calculations reveal all the qualitative results, demonstrating in particular the quantum oscillations of the thickness average of the nuclear reaction yield as a function of the incidence angle. Author (NSA)

N71-12061# Stanford Univ., Calif. High Energy Physics Lab.

EXCITATION OF PARTICLE-HOLE STATES IN Si 28 BY INELASTIC ELECTRON SCATTERING AT HIGH MOMENTUM TRANSFER

I. Sick, T. W. Donnelley, Jr., J. D. Walecka, and G. E. Walker Aug. 1970 16 p refs Submitted for publication
(Contracts Nonr-225(67); F44620-68-C-0075; Grant NSF GP-9498)
(AD-712083; SU-HEPL-638; SU-ITP-364) Avail: NTIS CSCL 20/8

The predictions of the particle-hole model for 28Si are compared with experimental results for large-angle high-momentum-transfer inelastic electron scattering. A few high-spin T = 1 states are seen to dominate the cross section. Author (TAB)

N71-12082# Stanford Univ., Calif. High Energy Physics Lab.

CHARGE DISTRIBUTION OF THE EVEN Nd-ISOTOPES

J. H. Heisenberg, H. S. McCarthy, I. Sick, and M. R. Yearian Jul. 1970 30 p refs Submitted for publication Sponsored in part by Bundesministerium fuer Wiss. Forsch.
(Contract Nonr-225(67))
(AD-712082; SU-HEPL-615) Avail: NTIS CSCL 20/8

High energy electron scattering has been used to deduce the nuclear charge distribution of the isotopes 142, 144, 146, 148, 150Nd. The measured cross sections have been fitted using a two- and a three-parameter Fermi shape. A significant increase of the surface thickness between 142Nd and 150Nd is observed. The data for 142Nd at high momentum transfer can only be fitted by introducing a modification on the charge distribution which is due to shell model effects. Author (TAB)

N71-12123# Oak Ridge National Lab., Tenn.

WAVE-PARTICLE ENERGY TRANSFER AND WAVE-AMPLITUDE LIMITING EFFECTS

D. J. Sigmar and J. D. Callen Jul. 1970 30 p refs Submitted for publication
(PB-193690; ORNL-TM-3067) Avail: NTIS CSCL 20I

The change of energy and phase of a particle gyrating in a homogeneous magnetic field and a perpendicularly propagating electrostatic wave is calculated analytically for resonant and nonresonant frequencies in the regime where the wavelength 2 pi K perpendicular sup (−1) is of the order of the gyroradius a. This result provides a quantitative basis for a simple wave-particle interaction model and resolves certain discrepancies between previously obtained results and numerical calculations of the ranges of K perpendicular (a) for which instability is possible. The long time behavior of the particle motion is discussed using a stroboscopic orbit theory. Author (USGRDR)

N71-12130# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

CATALOGUE OF beta AND gamma ACTIVITIES OF FISSION PRODUCTS [BIBLIOTHEQUE DES ACTIVITIES beta ET gamma DES PRODUITS DE FISSION]

Bertrand Barre and Roland de Tourreil Apr. 1970 67 p refs In FRENCH
(CEA-N-1269) Avail: AEC Depository Libraries

The whole of the data concerning the beta and gamma activities of fission products used for the codes PEPIN-LE-BREF and PICFEE are presented in the form of 4 comprehensive tables:one for the nuclides, one for gamma rays, one for energy balances and a fourth for the nuclide chains. Author (NSA)

N71-12131# Lyon Univ. (France). Inst. de Physique Nucleaire.

ASYMMETRIES PRODUCED BY 28-MeV VECTOR-POLARIZED DEUTERONS IN ELASTIC SCATTERINGS ON C-12, SI-28, Ca-40 [ASYMETRIES PRODUITES PAR DES DEUTONS DE 28-MeV POLARISES VECTORIELLEMENT DANS LES DIFFUSIONS ELASTIQUES C-12, SI-28, Ca-40]

J.-P. Burq, G. Hadinger, J. Kouloumdjan, and J. Meyer 31 Mar. 1970 21 p refs In FRENCH
(LYCEN-7021) Avail: AEC Depository Libraries

The asymmetries that appear in the elastic scattering of vector polarized deuterons were measured. The deuterons were produced in a source adpated to the 28-MeV synchrocyclotron of the Nuclear Institute of Lyon. The interpretation made in the framework of the optical model gives very satisfying results for the experimental asymmetries. NSA

N71-12132# Lyon Univ. (France.) Inst. de Physique Nucleaire.

REACTION (alpha 2 alpha) ON Li-6, Li-7, Be-9, C-12, AND O-16 AT 55 Mev [REACTION (alpha, 2 alpha) SUR Li-6, Li-7, Be-9, C-12, ET O-16 A55 MeV]

J. R. Pizzi, M. Gaillard, P. Gaillard, A. Guichard, M. Gusakow et al 26 Feb. 1970 4 p refs In FRENCH
(LYCEN/7009) Avail: AEC Depository Libraries

The (alpha,2alpha) reaction was studied on Li-6, Li-7, Be-9, C-12, and O-16 nuclei at 55 MeV, assuming a quasi-elastic scattering mechanism. The experimental results were studied in the framework of the plane-wave impulse approximation . The angular distributions obtained are given. Author (NSA)

N71-12133# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Experimentelle Kernphysik.

SEARCH FOR PARITY VIOLATION IN THE 2.010 MeV TRANSITION IN Ca 41 AFTER POLARIZED NEUTRON CAPTURE

J. Eichler Mar. 1970 9 p refs
(KFK-1160) Avail: AEC Depository Libraries

Polarized states were produced in Ca-41 by capture of polarized thermal neutrons. The asymmetry coefficient A in the angular distribution of the 2.010 MeV (3/2(+) − 7/2(−)) gamma ray was A = (1.1 + or − 3.2) × .0001. Author (NSA)

N71-12134# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.

CALCULATIONS OF ENERGY SPECTRA OF FISSION FRAGMENTS AND VALUES ANTINEUTRINO FOR TARGETS OF DIFFERENT THICKNESS

E. Dermendzhiev and Ts. Panteleev 1970 15 p refs In RUSSIAN
(JINR-P3-5081) Avail: AEC Depository Libraries

Energy spectra of fission fragments and antineutrino values are calculated for targets of different thickness. The results together with the data from the paper by S. Bochvarov et al. give the value of the energy charge of fragments in U-235 resonances. It is shown that the account of the instrumental effect, connected with the fragment yield from relatively thick targets, does not eliminate the contradictions between the Dubna and USA data on antineutrino in Pu-239 resonances. Author (NSA)

N71-12135# Institute of Nuclear Research, Warsaw (Poland).

THE INVESTIGATION OF THE PROBABILITIES OF ELECTROMAGNETIC TRANSITIONS IN NUCLEI WITH MASS NUMBER 125 LESS THAN OR EQUAL TO A LESS THAN OR EQUAL TO 153

Jan Kownacki 1970 130 p refs In POLISH
(INR-1149) Avail: AEC Depository Libraries

The half-life measurements of some excited states of I-125,I-127, Te-125, Sm-147, Sm-149, and Eu-151 were performed. The delayed coincidence method was applied using a time-to-amplitude converter and long-lens magnetic beta-ray spectrometer adapted for the life time measurements. Based upon these measurements the reduced transition probabilities were established. The results were compared with the predictions of the single particle model as well as with the pairing-plus-quadrupole model used for spherical nuclei. Author (NSA)

N71-12136# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.

PARAMETERS OF NEUTRON RESONANCES U-233, U-235, AND PU-239

Yu. V. Ryabov, So Ton Sik, N. Chikov, and N. Yaneva 1970 36 p refs
(JINR-P3-4992) Avail: AEC Depository Libraries

The total cross sections of U-233, U-235, and Pu-239 and the fission and radiative capture cross sections of U-235 and Pu-239 were measured by the time of flight method with time resolution of 40 and 55 ns/m using the pulsed fast reactor. The liquid boron scintillation detector was used to detect the resonance neutrons in the measurements of the total cross sections by the transmission method. The measurement of the total cross sections and that of fission and radiative capture by the self indication method were carried out using a large cadmium loaded liquid scintillation detector. The parameters (g)Gamma sub n, Gamma, Gamma sub f, and Gamma sub c for 78 levels of U-235 and 32 levels of Pu-239 and the parameters (g) Gamma sub n Gamma for 13 levels of U-233 were calculated by the area method. Author (NSA)

N71-12137# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.

INVESTIGATION OF THE PROPERTIES OF THE SPONTANEOUSLY FISSIONING ISOMER Pu-241 IN THE REACTION (GAMMA,n)

Yu. P. Gangrskii, B. N. Markov, and Yu. M. Tsipenyuk 1970 9 p refs

(JINR-E15-5071) Avail: AEC Depository Libraries

The reaction Pu-241(gamma,n) was studied in which a spontaneously fissioning isomer Pu-241 was formed with 23 + or − 1 sec half life. The ratio of the formation cross sections for isomeric and ground states of Pu-241, (9 + or − 2) × .0010, was measured along with the threshold of the reaction of isomeric state formation, (9.1 + or − 0.15). From the comparison of the thresholds of the reaction leading to the ground and isomeric state the excitation energy of the spontaneously fissioning isomer Pu-241, 2.9 + or − 0.15 MeV, was determined. The data obtained are compared with the results on subbarrier resonances in the reaction Pu-240(n,f). Author (NSA)

N71-12161# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

ON THE INVESTIGATION OF THE ATOMIC NUCLEUS STRUCTURE

V. G. Solov'ev 1970 11 p In RUSSIAN

(JINR-P4-5045) Avail: AEC Depository Libraries

Basic directions in the investigation of nuclear structure are presented. General attention is paid to the ways of studying the low-excited states of medium and heavy nuclei. Author (NSA)

N71-12162# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Kernphysik.

NUCLEAR SPECTROSCOPIC INVESTIGATIONS OF THE DECAY Hg-191 YIELDS Au-191

H. Beuscher, P. Jahn, R. M. Lieder, and C. Mayer-Boericke Apr. 1970 18 p refs In GERMAN Presented at the German-Holland Meeting on Nucl. Phys., Eindhoven, Netherlands

(JUL-659-KP; CONF-700321-1) Avail: AEC Depository Libraries

The decay Hg-191 yields Au-191 was investigated. The mother isotope was produced in the Julich isochronous cyclotron via the reaction Au-197(d,8n)Hg-191 with 80-MeV deuterons. The study of the decay was performed using Ge(Li) detectors and an orange-type beta-ray spectrometer. Energies and relative intensities of 16 new gamma transitions were measured. For 9 transitions the multipolarities could be determined. A new isomeric state was observed in Au-191 with a half-life of 1.2 + or − 0.3s. Author (NSA)

N71-12166# Oak Ridge National Lab., Tenn.

THE NEUTRON-INDUCED ACTIVITY AND DECAY POWER OF THE NIOBIUM STRUCTURE OF A D-T FUSION REACTOR BLANKET

D. Steiner Aug. 1970 16 p refs

(Contract W-7405-ENG-26)

(ORNL-TM-3094) Avail: NTIS

Calculations of the neutron-induced activity and decay power associated with the niobium structure of a representative D−T fusion reactor blanket are presented. For a 5000-MW (thermal) reactor, after ten years of operation, the induced activity is approximately 2 × 10 to the tenth power curies and in the long term decays with a half-life of 13.6 years; the decay power is approximately 50 MW and in the long term decays with a half-life of 35 days. These levels of induced activity and decay power are non-trivial and must be considered in the design requirements of a fusion reactor power plant. Author (NSA)

N71-12171# Lyon Univ. (France). Inst. de Physique Nucleaire.

A THEORETICAL ANALYSIS OF (ALPHA, 2 ALPHA) REACTIONS USING TRIANGULAR GRAPHS

B. Mithra and R. Laverriere May 1970 17 p refs

(LYCEN-7031) Avail: AEC Depository Libraries

This study concerns (alpha, 2 alpha) reactions in the scheme of the dispersion theory. Triangular graphs taking into account a final state interaction are considered. Numerical calculations are made for 56-MeV incident energy with Li-6, Be-9, C-12, and O-16 as targets in a coplanar and symmetrical geometry. A good agreement is obtained, especially for carbon and oxygen. Author (NSA)

N71-12178# Tubingen Univ. (West Germany).

LOW LYING STATES OF LIGHT ATOMIC NUCLEI IN THE FRAMEWORK OF THE CLUSTER MODEL [DIE NIEDRIG LIEGENDEN ZUSTAENDE LEICHTER ATOMKERNE NACH DEM CLUSTERMODELL]

W. Wodsak Feb. 1970 114 p refs In GERMAN; ENGLISH summary

(BMBW-FBK-70-2) Avail: AEC Depository Libraries; ZAED DM 23.95

Different types are discussed for the Jastrow factor of the wavefunction which is necessary for calculations with realistic potentials, and they are investigated exactly and approximately. The ground states of H-3 and He-3 are calculated with a realistic potential containing tensor forces, using the Ritz variational method. The nuclei H-2, H-3, He-3, He-4 are described by 2-6 wave-functions of spatial symmetry. The lowest states of Li-6 are calculated by a superposition of He-4, H-2) and (He-3, H-3) cluster model wavefunctions in a pure central potential. Author (NSA)

N71-12180# Rikkyo Univ., Yokosuka (Japan). Inst. for Atomic Energy.

MEASUREMENTS OF THE FAST NEUTRON SPECTRA IN THE REACTOR CORE AND THE THERMAL COLUMN OF THE RIKKYO REACTOR

Akiharu Kitahara and Susumu Harasawa [1970] 32 p refs

(IAERU-7001) Avail: AEC Depository Libraries

The fast neutron spectra in the core and the thermal column of the Rikkyo reactor were measured by the foil activation method. Four kinds of material, indium, nickel, titanium and aluminium, were used for the detecting foils. The calculation method of spectra was the least-squares series expansion proposed by G. Di Cola and A. Rota. Three fictitious spectra were used in order to test the effect of the foils and the accuracy of the calculation method. The fast neutron spectrum from the measured activation rates in the center of the reactor core was similar to the fission neutron spectrum, while at the upper part of the core, the spectrum around 6 MeV was a little lower than the fission spectrum. The spectrum in the thermal column differed from the fission neutron spectrum in having a fairly large depression near 3.5 MeV. The fast neutron flux was about one per cent of the thermal neutron flux. Author (NSA)

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N71-11173# Oak Ridge National Lab., Tenn.

ON THE STABILITY OF MICROWAVE HEATED PLASMAS

G. E. Guest and D. J. Sigmar May 1970 35 p refs
(Contract W-7405-eng-26)
(PB-192686; ORNL-TM-3005) Avail: NTIS CSCL 20I

Magnetically-confined plasmas, created and heated by electro-magnetic fields near the electron gyrofrequency, can support several modes of instability driven by inherent temperature anisotropy or possible loss-cone effects. If T parallel is much less than T perpendicular, both electrostatic and electromagnetic waves can grow in time; while if T parallel approaches T perpendicular, electrostatic waves at the hybrid frequency can be driven unstable by the loss-cone effect. The relevant known criteria are reviewed and several new criteria are developed to describe the stabilization of the temperature-anisotropy modes as T parallel approaches T perpendicular. Author (USGRDR)

N71-11174# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

RADIATION FROM AN APERTURE IN A CONDUCTING PLANE COATED WITH A MOVING PLASMA LAYER

W. Lawrence Hatt (M.S. Thesis) Mar. 1970 77 p refs
(AD-712010; GE/EE/70-10) Avail: NTIS CSCL 20/14

The radiation from a slot-excited infinite ground plane covered with a moving isotropic plasma layer is considered. Radiation patterns are given for a selection of frequencies and velocities parallel to the slot. It is found that layer motion produces a cross-polarized field in addition to changes in the normal stationary field. Both effects are largest for wave frequency near plasma frequency or velocity near velocity of light. In addition all radiation is attenuated over a range of velocities when wave frequency is less than plasma frequency. The attenuation range is lower for wave frequencies near the plasma frequency. Author (TAB)

N71-11428*# Aeronautical Research Associates of Princeton, Inc., N.J.

RESEARCH IN THE THEORY OF MAGNETOHYDRODYNAMIC TURBULENCE Final Report

Guido Sandri Aug. 1970 88 p
(Contract NASw-1778)
(NASA-CR-111804) Avail: NTIS CSCL 20I

Research was conducted aimed at understanding the behavior of a plasma when it is unstable and therefore potentially turbulent, but in which collisional effects cannot be neglected. The investigation was prompted by a previous study in which it was shown that the classical kinetic theory, based on adiabatic assumption, fails to give a proper asymptotic characterization of the two-particle correlation function on time scales of the order of the relaxation time of the system. The results of this research demonstrate that the inclusion of three-body collisions damps the peak value of the two-particle correlation, which in leading order has the form of a wave traveling in the direction of the relative velocity of the particle pair. In addition, it was possible to obtain the kinetic equation to higher order and prove explicitly the H-theorem for the velocity distribution function, including three-body effects. D.L.G.

N71-11458# Nagoya Univ. (Japan). Inst. of Plasma Physics.

MAGNETIC AND DRIFT SURFACES, CURRENT CONFIGURATION OF STELLARATOR FIELD

Kenro Miyamoto Aug. 1970 24 p refs
(IPPJ-95) Avail: NTIS

Magnetic surfaces and drift surfaces of a single charged particle of a stellarator field are analysed by using an average method. The dependences of the rotational transform angle and the magnetic well depth on the parameters of current configuration of the stellarator field are studied in case of long and short pitch of helical windings to find the optimum parameters. The relation of magnetic and drift surfaces are examined and a condition for their small deviation is deduced. The properties of isobar surfaces are examined. Author

N71-11461*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXPERIMENTAL STUDY OF SPECTRAL INDEX, MODE COUPLING, AND ENERGY CASCADING IN A TURBULENT, HOT-ION PLASMA

J. Reece Roth [1970] 33 p refs Presented at the 12th Ann. Meeting of the Plasma Phys. Div. of the Am. Phys. Soc., Washington, D.C., 4-7 Nov. 1970
(NASA-TM-X-52919) Avail: NTIS CSCL 20I

The spectrum of electrostatic potential fluctuations was measured with a capacitive probe in a steady-state, turbulent plasma confined in a magnetic mirror geometry. When oscillation peaks were absent, the background spectrum of electrostatic potential fluctuations had a power-law dependence on frequency over the range 0.2 to 1.0 MHz. The value of the spectral index depended on the probe position in the magnetic field, and, at a given position, depended on the plasma characteristics. The effects of a sinusoidal external modulation of the anode voltage were assessed over the range 0-100 kHz. The spectra exhibited several mode coupling phenomena, including enhanced harmonics of the externally imposed frequency, and sideband modulation of internally generated oscillation peaks. External excitation of the plasma at frequencies below 50 kHz resulted in only a small degree of ion heating. Author

N71-11799# Nagoya Univ. (Japan). Inst. of Plasma Physics.

UNSTABLE BGK SOLUTION DUE TO EXCITATION OF AN ION ACOUSTIC WAVE

T. Hatori, R. Sugihara, and T. Watanabe Sep. 1970 11 p refs
(IPPJ-99) Avail: NTIS

Some comments on the stability of the BGK solutions are given using idealized models, and a possibility is shown of excitation of an ion acoustic wave by trapped electrons in a large amplitude potential trough. Author

N71-11800# Nagoya Univ. (Japan). Inst. of Plasma Physics.

EXPERIMENTAL INVESTIGATION OF A SLOW THETA PINCH PLASMA (BSG 1)

Kiyoshi Hayase and Takayoshi Okuda Sep. 1970 38 p refs
(IPPJ-96) Avail: NTIS

Various properties and behaviors of a plasma in a slow theta-pinch are measured and investigated. Basic parameters such as the temperature and density are measured in a wide pressure range by laser scattering and interferometry. The characteristics of the temperature and the compression time are compared with a snow plow model. Some discussions about the stabilization effects are described. The end loss is also measured and the e-folding time is more than 20 microseconds. To produce a plasma of low density, z-discharge preionization is applied, and the slow theta-pinch is operated in the first half cycle. A new method is applied to initiate the z-discharge even at very low pressure. This allows investigation of a collisionless plasma in a theta-pinch, in which some anomalies on the contraction and heating are observed. Author

N71-11834# Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics.

MINIMUM TEMPERATURE AND POWER EFFECT OF COSMICAL PLASMA INTERACTING WITH NEUTRAL GAS

B. Lehnert 9 May 1970 25 p refs
(Rept-70-11) Avail: NTIS

Regions exist in cosmos, such as the surface layers of stars and cool interstellar clouds, which are lowly ionized in an undisturbed state. Fully ionised plasmas which are produced within limited volumes of these regions will interact with the surrounding neutral gas through partially ionised boundary regions, in a way depending on an immersed magnetic field. Due to the neutral gas interaction, a minimum power input and temperature exist below which the fully ionized plasma cannot be sustained in a quasi-stationary state. This limit is sharply defined and should under certain conditions produce abrupt disappearances or appearances of cosmic phenomena both in time and space, even when the parameters involved are being changed gradually and slowly. Possible applications of this minimum effect are related to solar prominences and their sudden disappearance, and to rotating plasma phenomena in the solar atmosphere. The mechanisms which produce the minimum effect are based on an overall plasma balance considered earlier by Stroemgren in connection with interstellar clouds. An experimental demonstration of the minimum effect is given under laboratory conditions and its scaling to cosmic conditions is discussed. Author (ESRO)

N71-11835# Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics and Fusion Research.

DIVISION OF PLASMA PHYSICS AND FUSION RESEARCH, ROYAL INSTITUTE OF TECHNOLOGY, STOCKHOLM **Progress Report 1970**

B. Lehnert Jul. 1970 51 p refs
(Rept-70-20) Avail: NTIS

The lines of research at the Division of Plasma Physics and Fusion Research are outlined and previous results and future plans summarized. The activities are mainly concentrated on basic plasma physics and its application to the thermonuclear fusion problem, but other fields are also involved in the research program such as cosmical physics, special technical applications of plasmas, and the development of diagnostical methods and experimental devices. Author (ESRO)

N71-11836# Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics.

HIGH FREQUENCY HEATING OF A DENSE FULLY IONIZED PLASMA

B. Lehnert, J. Bergstroem, M. Bures, and E. Tennfors 25 May 1970 6 p refs Sponsored jointly by Swed. Atomic Res. Council and Bank of Swed. Tercentary Fund
(Rept-70-13) Avail: NTIS

A dense fully ionized plasma with a neutral gas blanket is confined in an internal ring device. High-frequency power of about 0.5 MW is absorbed by the plasma at the magnetoacoustic resonance. The plasma can be sustained when the power input exceeds a certain minimum level. The losses along the magnetic field affect the plasma balance at small fluid velocities, as expected from theory. There are indications that the plasma can be stabilized against flute disturbances by line-tying effects which are controlled by external means. Author (ESRO)

N71-11837# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.

REVIEW OF ALFVEN'S CRITICAL VELOCITY HYPOTHESIS. PART 3: THEORY

J. C. Sherman Aug. 1970 49 p refs
(Rept-70-30) Avail: NTIS

Theories that have been proposed, e.g. explanations of Alfven's critical velocity hypothesis, are reviewed and discussed. ESRO

N71-11851# Miami Univ., Coral Gables, Fla. Dept. of Physics.

BROKEN SYMMETRIES AND CTR CONFINEMENT **Final Report, 1 Sep. 1968 – 15 Sep. 1970**

Daniel R. Wells 15 Sep. 1970 20 p refs
(Contract F19628-69-C;0072)
(AD-712363; AFCRL-70-0457) Avail: NTIS CSCL 20/9

A new approach to magnetohydrodynamic flow stability is outlined. The concept of space-time and gauge symmetries of the flow fields are utilized in developing a nonlinear global theory of stability. New experimental data is presented which indicates that the stable structures predicted by the theory are actually produced in the laboratory. Author (TAB)

N71-11852# International Centre for Theoretical Physics, Trieste (Italy).

EFFECT OF LONGITUDINAL ELECTRIC FIELD ON TOROIDAL DIFFUSION

P. H. Rutherford, L. M. Kovrizhnikh, M. N. Rosenbluth, and F. L. Hinton Jul. 1970 12 p refs Submitted for publication
(IC/70/74) Avail: NTIS

The driving toroidal electric field in tokamaks is shown to lead to a significant pinching effect at low collision frequency. For beta sub theta = 8 pi p/sq B sub theta less than 1 where B sub theta is the poloidal field, this pinching is more rapid than outward diffusion in the banana and plateau regimes of toroidal transport theory. Author (ESRO)

N71-11853*# Stanford Univ., Calif. Inst. for Plasma Research.

PARTICLE FLUX ASSOCIATED WITH STOCHASTIC PROCESSES

C. E. Newman, P. A. Sturrock, and E. Tademaru Aug. 1970 9 p refs
(Grant NGL-05-020-272; Contract F44620-69-C-0008)
(NASA-CR-111402; SU-IPR-386) Avail: NTIS CSCL 20I

The Lagrange expansion, which may be used to derive the Fokker-Planck equation, is here used to derive the corresponding expression for the flux of particles subject to a stochastic scattering process. The coefficients which occur in this expression are, in general, not the same as the coefficients which occur in the Fokker-Planck equation itself. In the special case that the particle distribution involves only one independent variable, the particle flux is determined by the familiar Fokker-Planck coefficients. Evaluation of particle flux is of special interest in the study of stochastic acceleration. Author

N71-11860# Aerospace Corp., El Segundo, Calif. Lab. Operations.

SURFACE AND BULK WAVES ON AXIALLY MAGNETIZED PLASMA COLUMNS **Research Report, Sep. 1967 – Aug. 1968**

Vladislav Bevc 1 Sep. 1970 51 p refs
Contract F04701-70-C-0059)
(AD-711649; TR-0059(9220-02)-1; SAMSO-TR-70-309) Avail: NTIS CSCL 20/9

The dispersion relation and field solutions of slow electromagnetic waves propagating along a cold, collisionless, cylindrical plasma in an axial magnetic field of finite magnitude are studied numerically. Field distribution and gradual metamorphosis of surface waves into bulk waves along the dispersion characteristics are investigated. It is shown that both surface waves and bulk waves belong to the same set of plasma modes. Criteria concerning conditions under which surface waves occur are extended to include transitional situations. Power-flow density along the plasma may in certain cases be in opposite directions inside and outside of the plasma both for forward surface waves as well as for backward cyclotron waves implying transfer of energy between propagation media. Author (TAB)

N71-11861# Aerospace Corp., El Segundo, Calif. Lab. Operations.

ON THE POWER FLOW IN PLASMA-FILLED WAVEGUIDES **Technical Report, 1 Jan. 1965 – 1 Sep. 1968**

Vladislav Bevc 1 Sep. 1970 45 p refs
(Contracts AF 04(695)-669; F04701-70-C-0059)
(AD-711648; TR-669(9220-03)-1; SAMSO-TR-70-307) Avail: NTIS CSCL 20/9

The power flow of two types of cyclotron modes propagating in a waveguide filled with a cold collisionless axially magnetized plasma is studied as a function of the location of the point of operation on the Brillouin (omega-beta) diagram. Dynamic analysis is used throughout. Partition of the total power flow corresponding to E, H, and EH power is examined and compared with results obtained by the quasi-static approximation in the domain of its presumed validity. A comparison is made of suitably normalized total power flow as a function of the propagation constant for various representative examples of mode types. The inadequacy of the quasi-static approximation for the analysis of the power flow for dynamic cases and properties of cyclotron and plasma guide modes are discussed. Author (TAB)

N71-11862# Oak Ridge National Lab., Tenn. Thermonuclear Div.

ANOMALOUS RESISTIVITY IN A STEADY-STATE, CURRENT CARRYING DISCHARGE TUBE PLASMA

A. Hirose, I. Alexeff, W. D. Jones, and K. E. Lonngren (Iowa Univ.)
Aug. 1970 15 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3038) Avail: NTIS

The dc electrical conductivity in a turbulent cylindrical discharge-tube plasma was measured as a function of dc electric field over the range 0.06 to 300 V/cm. The observed conductivity is much lower than that due simply to collisions of electrons with ions and neutrals, and is explained in terms of current-driven electrostatic instabilities. Below approximately 60 V/cm the conductivity exhibits three distinct dependences upon the dc electric field, each of which can be interpreted quantitatively in terms of the ion—acoustic wave instability. Above 60 V/cm the conductivity is approximately constant and about an order of magnitude lower than that calculated for the two-stream instability and observed experimentally in a transiently turbulent plasma. Author (NSA)

N71-11866# California Univ., Livermore. Lawrence Radiation Lab.

FEEDBACK CONTROL OF FLUCTATIONS IN A TOROIDAL STELLARATOR

C. W. Hartman, H. W. Hendel, and R. H. Munger 4 Jun. 1970 15 p refs Presented at the Symp. on Feedback and Dyn. Control of Plasmas, Princeton, N.J. Submitted for publication Sponsored in part by AEC
(UCRL-72473; CONF-700616-1) Avail: NTIS

Identification of fluctuations and their suppression or enhancement by feedback is discussed for a plasma confined in a toroidal stellarator. Microwave-produced Xe plasma is studied in confining fields of about 1 kG. A critical threshold in helical winding current is observed above which the fluctuation level is 1% and below which low-order coherent fluctuations having a fluctuation level of 10% are observed. The fluctuations are identified as ballooning-type drift waves. Below the threshold helical winding current, unfiltered feedback of appropriate phase is observed to suppress the dominant lowest-order mode while a higher-order mode appears. Author (NSA)

N71-11867# Nagoya Univ. (Japan). Inst. of Plasma Physics.

PRODUCTION OF ION STREAM COMPOSED OF TWO COMPONENTS IN VELOCITY DISTRIBUTION

Tadao Honzawa Sep. 1970 14 p refs
(IPPJ-97) Avail: NTIS

The results of an experiment for investigating a source of ion beams composed of two components in energy distribution are reported. A diffusion-type plasma source is used, which is formed with two arrays of oxide-coated cathode rods and five sheets of metallic mesh grids. The energy distribution of the ion stream is observed with an electrostatic energy analyzer with a resolution of 4%. In the experiment ion streams of argon, helium, nitrogen, and their mixtures are obtained, the energy of which ranges from 50 to 500 eV. The energies of two components of the ion stream are determined by the biases applied externally to two pairs of grids, and their relative intensities can be controlled by adjusting the temperature of the front array of cathode rods and/or the potential of the intermediate grid. Author

N71-11868# Nagoya Univ. (Japan). Inst. of Plasma Physics.

NONLINEAR BEHAVIORS OF ION-WAVE

Masashi Kako and Tsuguhiro Watanabe Aug. 1970 21 p refs
(IPPJ-98) Avail: NTIS

The given equation is shown to govern the finite-amplitude ion wave propagating through a macroscopic plasma with an ion beam in the neighborhood of a marginally stable state. It is found that wave-trains or solitary waves exist. The temporal evolution of initial disturbances is investigated numerically. Author

N71-11869# Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics.

THE SPACE CHARGE EFFECTS OF NON-THERMAL IONS IN A MAGNETIC FIELD, INCLUDING THE EFFECTS OF A BACKGROUND PLASMA

J. C. Sherman Aug. 1970 32 p refs
(Rept-70-14) Avail: NTIS

The assumptions and approximations involved in Lehnert's theory of the space charge potential produced by nonthermal ions in a magnetic field are discussed, and this theory is extended to include the effects of a background plasma. Lehnert's theory is important as a possible justification of Alfven's critical velocity hypothesis. The possible application of Lehnert's theory in three situations where the critical velocity has been observed or proposed is briefly considered. This theory could be important for Alfven's theory of the origin of the solar system. Author (ESRO)

N71-11870# European Space Research Inst., Frascati (Italy).

INTERACTION OF LOW FREQUENCY ALFVEN WAVES WITH HIGH FREQUENCY ION-SOUND TURBULENCE

Andre Rogister 1970 30 p refs Presented at the 4th European Conf. on Controlled Fusion and Plasma Phys., Rome, Sep. 1970
Avail: NTIS

The interaction of low frequency, large scale oblique Alfven waves with high frequency, short wavelength, and one dimensional ion-sound microturbulence is investigated in the framework of kinetic theory. It is shown that the turbulence can lead either to spatial diffusion (damping) or antidiffusion (growth), with Bohm scaling, of the low frequency wave. Finite Larmor radius and frequency effects in the propagation of oblique Alfven waves are also obtained for arbitrary beta plasma; the results can easily be generalized, merely by deforming certain integration contours, to obtain the corresponding Landau decrement. Author (ESRO)

N71-11871# Nagoya Univ. (Japan). Inst. of Plasma Physics.

THE EFFECTS OF RF ELECTRIC FIELD ON DISPERSION OF ION WAVES

S. Aihara, S. Takamura, and K. Takayama Jul. 1970 29 p refs
(IPPJ-93) Avail: NTIS

The wavelength of ion wave decreases in RF electric field. The slowing down of ion wave becomes small as the frequency of ion wave increases. This phenomenon can be explained by the additional pressure which is produced by the spatial modulation of RF field on account of ion wave. A new branch of the dispersion relations of ion waves in a high frequency electric field is described. Author

N71-11872# European Space Research Inst., Frascati (Italy).

X-RAY TEMPERATURE MEASUREMENTS OF LASER PRODUCED PLASMAS

T. S. Green and L. Wolterbeek-Muller Jul. 1970 8 p refs Submitted for publication
(ESRIN-IN-88) Avail: NTIS

Measurements are reported of the temperatures obtained by laser irradiation of polythene, aluminum, and steel foils. The temperatures are derived from X-ray absorption measurements using beryllium absorbers. They show small variation with atomic weight of the target material being about 150 eV when using a Q-switched ruby laser of 6 joules energy output and 300 MW peak power. Author (ESRO)

N71-11873# European Space Research Inst., Frascati (Italy).

PRELIMINARY INTERPRETATION OF THE IRON SPARK LINE LIST OF FELDMAN AND COHEN

J. P. Connerade Jul. 1970 7 p refs Submitted for publication
(ESRIN-IN-94) Avail: NTIS

A table is given comparing iron spark line wavelengths, as measured by Feldman and Cohen, using a low inductance vacuum spark, with unpublished calculated values, as an aid to identification. ESRO

N71-11874# International Centre for Theoretical Physics, Trieste (Italy).

FORMATION OF DISCONTINUITIES BY NON-LINEAR INTERACTION OF LOW-FREQUENCY ELECTROMAGNETIC AND ION SOUND WAVES

A. Rogister and M. Dobrowolny Jul. 1970 8 p refs Submitted for publication
(IC/70/75) Avail: NTIS

Two coupled equations describing the nonlinear interaction of ion sound waves and low frequency electromagnetic waves are derived for the case where the two phase velocities are close to each other. These equations form a hyperbolic system, thus describing the formation of discontinuities, and can be relevant to the magnetic energy conversion problem in the physics of solar flares. Author (ESRO)

N71-11875# Australian National Univ., Canberra. Dept. of Engineering Physics.

MICROWAVE POWER TRANSMISSION RATIO: ITS USE IN ESTIMATING ELECTRON DENSITY

C. F. Vance Feb. 1969 18 p refs
(EP-RR-21) Avail: NTIS

The effect of a cylindrical plasma on transmission of microwave power between broad-beam antennas is calculated in the geometrical optics approximation. An eccentric plasma not filling the whole discharge tube, and possible enhanced transmission due to a lower density outer plasma are considered. When estimating peak density, the only other parameter which requires correction is the ratio of discharge to tube radius. Author

N71-12027# California Univ., Berkeley. Div. of Aeronautical Sciences.

AN EXPERIMENTAL STUDY OF THE CYLINDRICAL LANGMUIR PROBE RESPONSE IN THE TRANSITION REGIME

R. H. Kirchoff, E. W. Peterson, and L. Talbot Dec. 1969 59 p refs
(Grant AF-AFOSR-0538-67)
(AD-711095; AS-69-13) Avail: NTIS CSCL 20/9

Experiments were performed in a highly expanded low density flowing argon plasma using both single and double probes. Results are obtained in the near free-molecule regime over a wide range of ratios of Debye length to probe radius, probe length to probe radius, and probe radius to relevant mean free path. The effect of collisions on the ion-saturation current, the retarding field electron current, the floating potential and the inferred electron temperature was investigated experimentally. An existing approximate analysis describing the collisional single probe ion-saturation current and the retarding field electron current was extended to describe the collisional double probe characteristic and magnitude of the single probe floating potential. Author (TAB)

N71-12032*# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.

ION THERMALIZATION IN THE EARTH'S BOW SHOCK

Konstantinos Papadopoulos Sep. 1970 15 p refs
(Grant NGL-21-002-005)
(NASA-CR-111420; TN-BN-673) Avail: NTIS CSCL 20I

The role of the counterstreaming ion instability in thermalizing the solar wind ions in the earth's bow shock is discussed. It is shown that the interplanetary magnetic field plays an important role in the development of this instability. Comparison with recent experimental data shows that it can be the dominant mechanism of ion thermalization. Author

N71-12045*# Translation Consultants, Ltd., Arlington, Va.

EXPERIMENTAL STUDIES ON THE DISCHARGE PROPAGATION OF EXPLODING WIRES IN A HIGH VACUUM AND DETERMINATION OF THE DEVELOPING PLASMA PROPERTIES [EXPERIMENTELLE UNTERSUCHUNGEN ZUM ENTLADUNGSABLAUF VON DRAHTEXPLOSIONEN IM HOCHVAKUUM UND BESTIMMUNG DER EIGENSCHAFTEN DER ENTSTEHENDEN PLASMEN]

L. Niemeyer Washington NASA Dec. 1970 75 p Transl. into ENGLISH from German report
(Contract NASw-2038)
(NASA-TT-F-13346) Avail: NTIS CSCL 20I

Photographic observation of a plasma column produced by exploding wire in a high vacuum showed that the discharge column expanded until more or less stable contractions occurred and instabilities developed. Neutron production and contraction dynamics during discharge of a lithium wire enriched with deuterium indicate a plasma temperature of about 3 million degree K. Author

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N71-11418*# National Bureau of Standards, Washington, D.C., Electronic Technology Div.

METHODS OF MEASUREMENT FOR SEMICONDUCTOR MATERIALS, PROCESS CONTROL, AND DEVICES Quarterly Report, 1 Jan. – 31 Mar. 1970

W. Murray Bullis and A. J. Baroody, Jr., eds. Sep. 1970 66 p refs Sponsored in part by NASA, DASA, and Navy
(NASA-CR-111367; NBS-TN-555) Avail: SOD $0.65; NTIS CSCL 20L

NBS activities directed toward the development of methods of measurement are described for semiconductor materials, process control, and devices. Principal emphasis is placed on measurement of resistivity, carrier lifetime, and electrical inhomogeneities in semiconductor crystals; evaluation of wire bonds, metallization adhesion, and die attachment; and measurement of thermal properties of semiconductor devices and electrical properties of microwave devices. Work on related projects on silicon nuclear radiation detectors and specification of germanium for gamma-ray detectors is also described. Supplementary data concerning staff, standards committee activities, technical services, and publications are included. Author

N71-11425*# Teledyne Isotopes, Westwood, N.J.

A SEMICONDUCTOR MATERIAL RESEARCH PROGRAM

Peter Alexander and Herman Shulman 30 Jun. 1970 42 p refs
(Contracts NAS1-6654; DASA01-70-C-0040)
(NASA-CR-111793; IWL-2217-207) Avail: NTIS CSCL 20L

An experimental study was performed to ascertain the suitability of using germanium-silicon alloy single crystals to fabricate charged particle detectors. It was hypothesized that by selecting a suitable Ge/Si ratio, and thus defining the band gap value, operation of the detector at selected temperatures between +20 C and −195 C would be possible. The mixed constituent nature of the alloy lattice would also endow the alloy detectors with radiation damage resistant properties. The study demonstrates that charged particle detectors can be fabricated from germanium-silicon alloy crystals. These detectors are operable at temperatures above −75 C. Preliminary results indicate that the alloy may possess radiation damage properties superior to either germanium or silicon. Author

N71-11455*# Atomics International, Canoga Park, Calif.

A STUDY OF INHERENTLY STABLE HIGH-FIELD SUPERCONDUCTORS Summary Report, 25 Jun. 1968 – 31 Jul. 1970

S. L. Wipf and C. A. Guderjahn 25 Sep. 1970 32 p refs
(Contract NAS8-21415)
(NASA-CR-102919; AI-70-59) Avail: NTIS CSCL 20L

The problem of stability in superconducting materials was investigated with the goal of developing an intrinsically stable superconductor. The work includes theoretical studies of the problen of stability and flux jump as well as experimental studies of flux jumping in high field superconductors and the ac losses in superconducting coils. The study of ac losses in superconducting coils is presented in detail. Author

N71-11456# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Physics.

ON THE RELATIVE ORIENTATIONS OF THE ELECTRIC FIELD GRADIENT AND SUSCEPTIBILITY TENSORS IN MONOCLINIC SYMMETRY

W. T. Oosterhuis 1970 26 p refs Sponsored in part by NSF
(Contract N00014-67-A-0314-0005)
(AD-711621; TR-6) Avail: NTIS CSCL 20/12

Recently the orientations of the electric field gradient (EFG) and susceptibility (chi) tensors have been determined in several iron salts. It was shown that when a monoclinic crystal field is used, and the electron ground state was a single electron or hole (S = 1/2) then non-alignment of the EFG and chi is expected. It is the purpose of this report to show for the electronic system with a single electron in a d sub e orbital external to a filled subshell that the EFG and chi tensors will become reoriented with respect to each other under monoclinic symmetry. TAB

N71-11457*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXPERIMENTAL ANALYSIS OF THE FITZGERALD APPARATUS

James P. Cusick and Donald R. Behrendt [1970] 41 p refs
(NASA-TM-X-52917; E-6024) Avail: NTIS CSCL 20L

Experimental measurements on the dynamic compliance machine developed by E. R. Fitzgerald are presented to demonstrate that the anomalous modes associated with Fitzgerald's results are a consequence of large non-ideal drive tube motions. The drive tube designed by Fitzgerald is modified to permit external insertion or removal of a shorted turn similar to the one inherent in the original design. Experimental data is taken with and without the shorted turn on the drive tube. The sample compliance values computed from this data show that the shorted turn is responsible for the anomalous loss compliance values reported by Fitzgerald. Author

N71-11704*# General Electric Co., Philadelphia, Pa.

SPACE PROCESSING OF ELECTRONIC CRYSTALS

E. C. Henry and L. R. McCreight *In* NASA. Marshall Space Flight Center Space Process. and Manufacturing 21 Oct. 1969 p 59–78 ref (See N71-11701 02-15)
Avail: NTIS CSCL 20B

A method for growing various high temperature oxidic crystals is described. The crystals are precipitated and grown from a glass solvent in which the desired crystal constituents have been previously dissolved. It is proposed to conduct a space experiment on this process of growing crystals as a means of overcoming the gravitational effects, and to provide a means for achieving crystals with much higher perfection and improved electronic properties. Although several compositions of crystals have been grown, the recommended choice for a space experiment is potassium sodium niobate. Author

N71-11707*# Tyco Labs., Inc., Waltham, Mass.

DIRECTIONAL SOLIDIFICATION OF MULTICOMPONENT SUPERCONDUCTING SYSTEMS UNDER ZERO g CONDITIONS

J. T. A. Pollock and Fritz Wald *In* NASA. Marshall Space Flight Center Space Process. and Manufacturing 21 Oct. 1969 p 135–145 refs (See N71-11701 02-15)
Avail: NTIS CSCL 20L

Metallurgical microstructure plays a major role, through its influence on magnetic flux pinning, on the critical current density of superconducting materials. It has been found in technological practice that the capabilities of superconducting materials, as measured in short length samples, are rarely realized when long lengths of the same material are wound in a solenoid. This degradation has been attributed to magnetically induced thermal instabilities. A method is proposed for the preparation of stable superconducting cables comprising a filamentary phase of one superconducting in a matrix of another. This is to be achieved by directional solidification of appropriate superconducting systems under 0 g conditions. Author

N71-11717*# Westinghouse Electric Corp., Pittsburgh, Pa.

ZERO GRAVITY CRYSTAL GROWTH

Robert Mazelsky *In* NASA. Marshall Space Flight Center Space Process. and Manufacturing 21 Oct. 1969 p 297–305 refs (See N71-11701 02-15)
Avail: NTIS CSCL 20B

Briefly reviewed are the principles of crystal growth and the different techniques that are regularly used. The advantages and problems of the various techniques are characterized. It is shown that for at least the preliminary attempts at crystal growth, solution growth has the advantage over other techniques in that it will require the minimum amount of operator time, lower temperature operation, and will not require unusual safety requirements. An outline of the projected experiment in solution growth at zero gravity is described. Author

N71-11718*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

TECHNIQUES FOR CHARACTERIZATION AND EVALUATION OF ZERO GRAVITY GROWN GALLIUM ARSENIDE

Arun P. Kulshreshtha, T. Mookherji, and G. M. Arnett *In its* Space Process and Manufacturing 21 Oct. 1969 p 306–322 refs (See N71-11701 02-15)
Avail: NTIS CSCL 20L

Recent proposals concerning the advantages of purifying gallium arsenide and growing its single crystals in zero-gravity environment have led to an investigation into the possibilities of characterizing this material. Discussed are briefly several modern techniques which could be utilized to determine the ultratrace impurities and the dislocation-type imperfections and impurities influencing the electronic properties of gallium arsenide. Author

N71-11724*# North American Rockwell Corp., Thousand Oaks, Calif.

CRYSTAL GROWTH FROM MELTS IN ZERO g ENVIRONMENT

L. D. Fullmer and R. M. Housley *In* NASA. Marshall Space Flight Center Space Process. and Manufacturing 21 Oct. 1969 p 383–389 refs (See N71-11701 02-15)
Avail: NTIS CSCL 20B

The value of highly perfect single crystals to technology is discussed. Many potentially useful crystals which cannot be grown on earth because the melt cannot be contained, could be grown from containerless melts in 0-g. Very desirable increases in perfection of other crystals currently being used could probably be achieved in 0-g. The factors limiting perfection and their relation to gravity are discussed. Different techniques of growth in 0-g are discussed and a very versatile crystal pulling apparatus which combines the advantages of float zone refining and Czochralski growth is schematically described. Author

N71-11725*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

STUDIES OF ZERO GRAVITY EFFECTS ON SOLIDIFICATION

T. C. Bannister *In its* Space Process. and Manufacturing 21 Oct. 1969 p 390–402 refs (See N71-11701 02-15)
Avail: NTIS CSCL 20B

The major activities recently initiated in support of the manufacturing in space effort at the Marshall Space Flight Center will be discussed. These efforts are primarily aimed toward scientifically defining the role of gravity in the various processes involving solidification. Author

N71-11726*# Alabama Univ., Huntsville.

SINGLE CRYSTAL GROWTH FROM MELT UNDER SPACE ENVIRONMENT

Upendra Roy *In* NASA Marshall Space Flight Center Space Process. and Manufacturing 21 Oct. 1969 p 403–421 refs (See N71-11701 02-15)
Avail: NTIS CSCL 20B

A brief outline of the methods of single crystal growth from melt under 1-g is presented and their relative merits discussed. The role of near 0-g environment and other practical parameters important to the growth of perfect single crystals is considered. The effect of interface shape, high-g, gamma-ray irradiation and electromagnetic body force is reviewed. The experiment to study the growth kinetics under various equivalent gravity fields is discussed in more general terms and a partial list of the candidate materials suitable for space crystal growth is presented. Author

N71-11727*# Alabama Univ., Huntsville.

AN ANALYTICAL EXPERIMENTAL STUDY OF POSSIBLE EFFECTS OF GRAVITY ON CRYSTAL WHISKERS

Jack H. Davis *In* NASA. Marshall Space Flight Center Space Process. and Manufacturing 21 Oct. 1969 p 422–433 refs (See N71-11701 02-15)
Avail: NTIS CSCL 20B

Progress of analytical and experimental efforts to determine if a 1-g environment has any effect on whisker growth is reported. It is found analytically that the best quality whiskers are the ones most likely to be destroyed by gravity. A centrifuge experiment is set up to check this idea experimentally. The centrifuge is also being used to measure directly the effect of increased gravity on crystal growth by vapor deposition where convection is important. Author

N71-11728*# Lockheed Missiles and Space Co., Huntsville, Ala.

GRAVITY-DRIVEN AND SURFACE TENSION-DRIVEN CONVECTION IN SINGLE CRYSTAL GROWTH

Philomena G. Grodzka *In* NASA Marshall Space Flight Center Space Process. and Manufacturing 21 Oct. 1969 p 434–447 refs (See N71-11701 02-15)
Avail: NTIS CSCL 20B

Analytical and mathematical studies of the floating-zone and the Czochralski techniques of growing single crystals are being conducted. The objective of these studies is to elucidate the role of convection in single crystal growth. Gravity-driven and surface tension-driven convection and possible couplings between these two convective modes will eventually be incorporated into the analyses. The analyses are expected to provide a basis for predicting the effects of a zero-gravity environment on crystal growth. Author

N71-11838# California Univ., Berkeley. Lawrence Radiation Lab.

A STUDY OF THE SUPERCONDUCTIVITY OF METALS CONDENSED AT 4 K

James Adams Roberts, Jr. Jun. 1970 37 p refs
(Contract W-7405-eng-48)
(UCRL-19624) Avail: NTIS

The superconducting transition temperatures, T sub c, of electron-beam-evaporated metals (Al, Sn, and Pb) condensed on liquid-helium-cooled substrates were measured. The T sub c's of Al and Sn were increased above the bulk values to 3.1 and 5.09 K, respectively. The T sub c of Pb remained unchanged. The metals were also co-condensed with xenon resulting in further increases for the T sub c's of Al(3.7 K) and Sn(6.22 K) and a decrease for Pb. The effects of annealing on T sub c and normal-state resistance were also measured. Author (NSA)

N71-11839# Naval Ordnance Lab., White Oak, Md.

FERMI SURFACE STUDIES IN SnTe Final Report

Howard T. Savage 1 Jul. 1970 118 p refs
(AD-711797; NOLTR-70-119) Avail: NTIS CSCL 20/12

The de Haas-van Alphen effect (DHVA) at temperatures from 1.6K to 7.9K was used to investigate the Fermi surface of SnTe. DHVA data in SnTe separated into two regions, a normal region above a carrier concentration of 3 x 10 to the 20th power/cc and an anomalous region below. Above a carrier concentration of 3 x 10 to the 20th power/cc, oscillations of a second band were observed, in addition to the first band oscillations. The second-band pockets are probably non-parabolic and have a shape greatly elongated in a <100> direction. A <111> cyclotron mass and Dingle temperature were measured in the first band and a <100> cyclotron mass and Dingle temperature in the second. In addition, a density of states was determined. Below a carrier concentration of 3 x 10 to the 20th power/cc several branches were found describing the first-band pockets at L which are elongated in a <111> direction. Our observed minimum extremal cross section of the first band surface is more in agreement with the surface calculated by Rabii than with that calculated by Tung and Cohen. Author (TAB)

N71-11840# Office of Naval Research, London (England).

MARSTRAND CONFERENCE ON ATOMIC DIFFUSION

Lawrence M. Slifkin 4 Aug. 1970 24 p refs Conf. held 15-19 Jun. 1970
(AD-711418; ONRL-C-19-70) Avail: NTIS CSCL 20/12

A conference on atomic transport in solids and liquids was held on the island of Marstrand, Sweden. This conference placed special emphasis on atomic drift in electric fields and in thermal gradients, i.e., electro- and thermomigration. The majority of the papers dealt with solids, primarily metals, but there were several papers concerned with liquids and with non-metallic solids. One group of papers discussed the effect of high pressure on diffusion processes, and a number of reports considered the isotope and correlation effects. Author (TAB)

N71-11841# Harry Diamond Labs., Washington, D.C.

CZOCHRALSKI GROWTH OF TUNGSTATE AND MOLYBDATE SCHEELITES

Robert M. Curnutt Jul. 1970 20 p refs
(AD-711869; HDL-TM-70-8) Avail: NTIS CSCL 20/2

The processes of growing a series of nine scheelite-structured tungstates and molybdates with ten rare earth dopants by the Czochralski methods are described. Each material was prepared with several doping levels as well as in the pure form. Important details of all growth parameters are discussed, including annealing and optical finishing of samples for epr and optical absorption studies. Author (TAB)

N71-11842# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

THE PROBLEM OF GEOMETRICAL SELECTION OF CRYSTALS

A. N. Kolomogorov [1970] 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 65, no. 5, 1949 p 681–684
(AD-711880) Avail: NTIS CSCL 20/2

A mathematical theory of geometrical selection of crystals, nucleating at the boundary of a crystallizing mass is presented. The process under consideration is the growth of crystals between two parallel glass plates and from schematically graphic experiments, in which real crystals were replaced by gradually growing geometric figures, the initial orientation of which was selected at random (with the aid of the tables of random numbers). TAB

N71-11843# Defense Documentation Center, Alexandria, Va.
ZONE REFINING: A DDC BIBLIOGRAPHY, MAY 1961–April 1969, VOLUME 1
Agu. 1970 147 p refs
(AD-712000; DDC-TAS-70-72-1-Vol-1) Avail: NTIS CSCL 13/8

A compilation of annotated references on zone refining from the Defense Documentation Centers data bank is given. The zone refining, zone melting, or zone floatation technique is used for purification of ores and crystals. Author (TAB)

N71-11844# Nebraska Univ., Lincoln. Dept. of Physics.
STUDIES OF IMPERFECTIONS IN SOLIDS Final Technical Report
Edgar Pearlstein Jun. 1970 6 p refs
(Contract AT(11-1)-525)
(PB-192684; COO-525-35) Avail: NTIS CSCL 20L

Research progress is reported on thermal diffuse X-ray scattering measurements, simultaneous production and bleaching of F centers in KCl, stored energy in irradiated sodium chloride, continuous averaging of X-ray diffraction data using a multichannel analyzer, elimination of harmonic radiation in thermal diffuse X-ray scattering measurements, a study of thermal diffuse X-ray scattering from lead, coloration of KCl:OH(−) by ultraviolet light, radiation effects, alkali halides, lattice vibrations and defects, and ionic conductivity. USGRDR

N71-11845# Ballistic Research Labs., Aberdeen Proving Ground, Md. Signature and Propagation Lab.
EFFECTS OF HIGH ENERGY ELECTRON IRRADIATION ON SINGLE CRYSTALS OF AMMONIUM AND SODIUM BIFLUORIDE
Lawrence J. Vande Kieft Aug. 1970 35 p refs
(AD-712321; BRL-1490) Avail: NTIS CSCL 7/5

Radiation effects in single crystals of ammonium bifluoride and sodium bifluoride were studied by electron spin resonance and optical methods following 1-MeV electron irradiations at 77K. The irradiations changed the samples from clear to deep blue-green and both crystal types showed paramagnetic resonances which were determined to result from F2(-) ions in anion sites. This defect resulted from the displacement of hydrogen atoms from their normal positions in the linear bifluoride (FHF) (-) ions. Only in NH4HF2 were the displaced hydrogen atoms detected. Best-fit spin-Hamiltonian parameters for the F2(-) and H defects are given. Optical absorption measurements on the irradiated bifluorides are discussed. The ESR annealing characteristics for the F2(-) ions in both crystals appear to follow second-order kinetics. In two of the three inequivalent sites for F2(-) ions in NH4HF2 the orientation of the F2(-) molecular axis differs by eight degrees from the reported crystallographic axis of the corresponding bifluoride anion. This is interpreted to result from weaker hydrogen bonding between nitrogen and fluorine for the F2(-) ion than for the bifluoride ion in ammonium bifluoride, because of an increased N-H-F distance for the shorter F2(-) ions. Author (TAB)

N71-11846# European Space Research Inst., Frascati (Italy).
SUPERCONDUCTING AND NORMAL METALS IN A TIME-DEPENDENT GRAVITATIONAL FIELD
G. Papini (Saskatchewan Univ.) Aug. 1970 8 p refs Sponsored in part by Natl. Res. Council of Can.
(ESRIN-IN-100) Avail: NTIS

It is shown that time-dependent gravitational fields induct a time-dependent electromagnetic field in superconductors and normal metals. If they vary sinusoidally, the frequency is the same for both fields. It also follows that the dielectric constants of superconductors and normal metals are affected by a gravitational field. ESRO

N71-11856# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Dept. d'Etudes et de Recherches en Technologie Spatiale.
USE OF HALL EFFECT MEASUREMENTS FOR THE SIMULTANEOUS DETERMINATION OF DONOR AND ACCEPTOR CONCENTRATIONS IN SEMICONDUCTORS: APPLICATION TO N-TYPE SILICON [UTILISATION DE MESURES D'EFFET HALL POUR LA DETERMINATION SIMULTANEE DES CONCENTRATIONS DE DONNEURS ET ACCEPTEURS DANS LES SEMICONDUCTEURS: APPLICATIONS AU SILICIUM N]
A. Roizes, J. F. Roux, and R. Schuttler Jun. 1970 27 p refs
In FRENCH; ENGLISH summary
(ONERA-NT/02/16/70) Avail: NTIS

Electrically active impurities concentrations of donors, acceptors, and traps in n-type silicon were measured. The studied samples were of two kinds: (a) heavily phosphorus doped and aluminum compensated. In this case, there was a contribution to the conduction due to the impurity band. The Hall constant had a maximum value when the temperature changed and the temperature corresponding to this maximum was a function of doping and compensation level of the sample, and (b) slightly doped samples containing traps irradiated by 600 keV electrons. A least square fit adjustment was used and the fitted physical parameters were obtained with an error estimation. The donor and acceptor concentrations, the activation energy of deep level energy and the transport parameters characterizing the impurity band were thus determined simultaneously. It was also found that commercial n-type 10 ohm-cm silicon was heavily compensated by aluminum. Author (ESRO)

N71-11859# Watervliet Arsenal, N.Y. Benet R and E Labs.
ELECTRONIC CHARGE DISTRIBUTION IN CRYSTALS OF THE DIAMOND STRUCTURE FROM X-RAY DIFFRACTION INTENSITIES
Alma Marcus Gray Jul. 1970 46 p refs
AD-711931; WVT-7037) Avail: NTIS CSCL 20/2

A new method was developed, and computer programs were written for evaluating and plotting the electronic charge density in crystals of the diamond structure from x-ray diffraction form factors. Present calculations are restricted in the (110)-plane of diamond. This treatment is also applicable to Si, and it can be extended to other planes. Author (TAB)

N71-11866*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELECTRON PARAMAGNETIC RESONANCE STUDY OF CHROMIUM(+3) IN X-RAY IRRADIATED RUBY
David C. Liu Washington Nov. 1970 11 p refs
(NASA-TN-D-6079; E-5531) Avail: NTIS CSCL 20L

By EPR technique, dynamic measurements were made of the increase of Cr(+3) concentration in the X-ray irradiated ruby crystals during isothermal annealings. The thermal recovery of chromium ions to the +3 state was found to be a first-order process. The activation energy of this process was found to be 1.37 + or − 0.07 eV. The method described should be generally applicable to the study of decays involving paramagnetic centers. Author

N71-11881# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ON THE THEORY OF LOCALIZED ONE-ELECTRON STATES IN PERFECT CRYSTALS

Thomas A. Kaplan and Petros N. Argyres (Northeastern Univ., Boston, Mass.) 1 Sep. 1970 15 p refs
(Contract AF 19(628)-5167)
(AD-711372; TN-1970-27; ESD-TR-70-245) Avail: NTIS CSCL 20/12

In a recent paper a proof was given that for a perfect crystal of hydrogen atoms, described within a certain model, the free energy corresponding to localized one-electron wave-functions was less than that corresponding to spatially extended one-electron functions. That proof, however, depended on the assumption that the summand a sub l appearing in the partition function for the extended solutions monotonically increases with l for l = or > 0. The proof of this monotonicity is given here. Author (TAB)

N71-11900# Ballistic Research Labs., Aberdeen Proving Ground, Md.

THE SHOCK HUGONIOT OF SINGLE-CRYSTAL LITHIUM FLUORIDE

George E. Hauver and Angelo Melani Aug. 1970 18 p refs
(AD-712320; BRL-MR-2058) Avail: NTIS CSCL 20/12

Hugoniot data for single-crystal lithium fluoride have been obtained in the pressure range from 160 to 880 kilobars. The data indicate a phase transition near 420 kilobars. The transition is not identified, but is intuitively expected to be from the low-pressure face-centered-cubic form to the high-pressure body-centered form. Author (TAB)

N71-11924# McElroy (Ralph) Co., Austin, Tex. Custom Div.

STUDY AND CONSTRUCTION OF AN ENERGY-STORING SUPERCONDUCTING COIL

B. Girard et al [1970] 6 p Transl. into ENGLISH from Bull. Inst. Intern. Froid, Annexe (Paris), no. 1, 1969 p 419–423 Prepared for Los Alamos Scientific Lab.
(LA-TR-70-11) Avail: NTIS

A superconducting coil used to store energy and restore it in about one millisecond is described. Specially studied is the problem of current interruption. The coil was made from Nb–Ti stranded cable stabilized with pure aluminum. Its maximum energy content is approximately equal to 20 kJ and it is closely coupled with an aluminum ribbon coil that takes the place of the secondary coil of a non-iron transformer. The current is rapidly discharged by opening the circuit via a vacuum switch using an artificial zero-current injection system. This switch can break 1,000 A, without failure, with overvoltages of 4000 o 5000 V. It is capable of withstanding even higher voltages. The switching time is only a few microseconds. The stabilized superconducting coil withstood many charge rates of a few tenth of seconds duration and discharge rates of 3 or 4 milliseconds. Transfer energy rating is about 65%. At the moment, a part of the coil energy is being lost through induced currents being dissipated through the metal walls of the cryostat. Author (NSA)

N71-11925# Virginia Univ., Charlottesville. Dept. of Physics.

SURFACE SCATTERING AND OTHER SURFACE PHENOMENA Final Report

W. Cabrera and F. O. Goodman 30 Sep. 1970 8 p refs
(Grant AF-AFOSR-1569-68)
(AD-711409; AFOSR-70-2256TR) Avail: NTIS CSCL 7/4

The main purpose of this Grant was to develop the quantum mechanical theory of elastic and inelastic scattering of light atoms by crystal surfaces. In so far as the elastic theory is concerned it was shown the importance of the resonance scattering with the bound states (adsorbed or surface states) of the particle in explaining the experimental results, for He scattering on LiF. With regard to the inelastic scattering the authors have developed a one-phonon theory and suggested an experimental method which will permit to deduce complete information on the surface phonon spectrum. The Grant also pursued the development of the phenomenological theory of surfaces particularly regarding the stability of surface morphology during crystal growth and similar processes. Author (TAB)

N71-11926# Office of Naval Research, London (England).

CONFERENCE ON TRENDS IN DIFFUSION

Lawrence M. Slifkin 4 Aug. 1970 15 p refs Conf. held at Teddington, England, 25-26 Feb. 1970
(AD-711417; ONRL-C-18-70) Avail: NTIS CSCL 20/12

During February 25 and 26, 1970, under the sponsorship of the British Institute of Physics and the Physical Society, the National Physical Laboratory at Teddington was host to a Conference on the diffusion of atoms and diffusion-controlled processes in solids. This meeting consisted of somewhat more than two dozen contributed papers, almost all of which dealt with metals, there were only a few reports of work on semiconductors, oxides, and molecular crystals. Although most of the research described was on bulk diffusion, there were an appreciable number of papers concerned with mobility of atoms at interfaces. Author (TAB)

N71-11934# Iowa State Univ. of Science and Technology, Ames.

THE RADIO-FREQUENCY SIZE EFFECT AND THE FERMI SURFACE OF MOLYBDENUM

Joseph Robert Cleveland (Ph.D. Thesis) May 1970 127 p refs
(Contract W-7405-eng-82)
(IS-T-356) Avail: NTIS

The apparatus used to detect the RF size effect resonances measured the induced frequency changes of a variable-frequency oscillator by means of field-modulation techniques. The RF size effect measurements were made on flat plates of molybdenum with residual resistance ratio of 5000. Studies of the resonance line width vs frequency permitted an accurate determination of the resonance magnetic field values. From these measurements, very accurate Fermi surface dimensions along major crystallographic directions were determined. The results were compared with recent theoretical and experimental work on molybdenum. From the Fermi surface dimensions of the electron jack and the hole octahedra along H, the separation between the two Fermi surface pieces was estimated to be 0.149 + or – 0.014/A, which is 7% of the Gamma H distance. The indicated uncertainty in the gap dimension represents a 90% confidence limit. On the basis of this value for the gap, the spin–orbit coupling parameter for molybdenum is estimated to be 0.03 Ry. Author (NSA)

N71-11975# Kyoto Univ. (Japan). Research Inst. for Fundamental Physics.

A THEORY OF PHONONS IN AMORPHOUS SOLIDS AND ITS IMPLICATIONS TO COLLECTIVE MOTION IN SIMPLE LIQUIDS

Shozo Takeno and Masaki Goda (Hokkaido Univ.) Aug. 1970 47 p refs
(RIFP-109) Avail: NTIS

A theoretical study is made of phonons in amorphous solids using a self-consistent phonon scheme. In treating the structural disorder inherent in the problem, a theory is formulated from the viewpoint of multiple scattering theory and designed to give phonon eigenfrequencies which are expressed in terms of many-body correlation functions of atoms as well as of interatomic potentials in the solids. For this purpose, a conditional averaging procedure is applied to equations for phonon Green's functions obtainable using the renormalized harmonic approximation. A set of hierarchy equations are thereby obtained, for which various decoupling approximations are employed. Author

N71-12007# Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy and Materials Science.

THE SECOND ENERGY GAP IN SUPERCONDUCTING NIOBIUM

J. W. Hafstrom and M. L. A. MacVicar 24 Sep. 1970 28 p refs
(Contract N00014-67-A-0204-0041)
(AD-712072; TR-3) Avail: NTIS CSCL 20/12

Low temperature tunneling studies of high purity single crystals of niobium indicate the existence of two energy gaps, delta sub s and delta sub d, one for each of the two bands lying at the Fermi level. The value of delta sub is approximately delta sub d/19. The crystallographic dependence of delta sub s indicates that delta sub s does not appear in directions where there is no s-d overlap at E sub F. The behavior of delta sub s with temperature and magnetic field indicate that interband coupling is significant in niobium. The results are compared to current theories of multiband superconductivity. TAB

N71-12008# Hamburg Univ. (West Germany). Mineralogisch-Petrografisches Inst.
ELECTRICAL PROPERTIES OF QUARTZ AS RELATED TO IMPURITIES AND ELECTROLYTIC COLORING [ELEKTRISCHES VERHALTEN VON QUARTZ IM ZUSAMMENHANG MIT SEINEN GITTERFREMDEN BAUSTEINEN UND DER ELEKTROLYTISCHEN ANFAERBBARKEIT]
Peter E. Zaun (Ph.D. Thesis) 1970 73 p refs In GERMAN
Avail: NTIS

The mechanisms of electric color center forming of quartz in vacuum and in air are studied. Special attention is given to the electrical dissociation products in the crystal. The relation between electrical properties of the crystal and color center forming is also discussed. ESRO

N71-12009# Joint Publications Research Service, Washington, D.C.
EPITAXIAL SYNTHESIS OF DIAMONDS
B. V. Deryagin et al 9 Nov. 1970 8 p Transl. into ENGLISH from Priroda (Moscow), Sep. 1970 p 29–33
(JPRS-51742) Avail: NTIS

The synthesis of filamentary diamond monocrystals from a carbon-containing medium is discussed. The various methods by which diamonds have been produced by several researchers are presented. The success of Russian research and methods employed are described. Author

N71-12122# California Univ., Berkeley. Lawrence Radiation Lab. Inorganic Materials Research Div.
SUPERCONDUCTING TRANSITION TEMPERATURE OF DISORDERED TRANSITION METAL FILMS
Michael M. Collver (M.S. Thesis) Apr. 1970 33 p refs
(Contract W-7405-eng-48)
(PB-192687; UCRL-19186) Avail: NTIS CSCL 20C

Critical temperatures of superconducting transition metal films prepared by electron beam evaporation onto a helium cooled substrate were measured. Contrary to recent predictions of increased critical temperatures, no enhancement was observed in Nb, V, Ta, and Nb(0.85)Zr(0.15) films. However, Mo films were found to have the highest T sub c (8.3 K) yet observed. Nb, Nb-Zr, and Mo were also codeposited with xenon. In all these films, the T sub c was found to be lower than for corresponding films without xenon. The effects of annealing on T sub c were also determined. Author (USGRDR)

N71-12161# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
CONDUCTION MECHANISMS IN HIGH QUALITY GALLIUM ARSENIDE
John F. Scheerer (M.S. Thesis) Jun. 1970 70 p refs
(AD-712004) Avail: NTIS CSCL 20/12

The purpose of the project was to investigate the conduction mechanisms in high quality GaAs by precisely measuring the resistivity and Hall constant and from this calculate the mobility. These results were then compared to theory. Equipment for this purpose was designed and built. A bulk GaAs specimen was investigated. The results showed that a combination of polar-optical and ionized impurity scattering were the predominate mechanisms from room temperature to 66K, and that ionized impurity scattering was predominate from 66K to 20K. From 20K to 4.2K no determination of scattering mechanisms could be made because the assumption that the value of the scattering factor was one, was not valid in this range. Author (TAB)

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N71-11848# Army Foreign Science and Technology Center, Washington, D.C.
MICROBIOLOGIC CORROSION [MIKROBIOLOGICHESKAYA KORROZIYA]
A. Smolin May 1970 11 p Transl. into ENGLISH from Aviat. Kosmonavt. (USSR), no. 12, 1969 p 38–39
(AD-712103; FSTC-HT-23-863-70) Avail: NTIS CSCL 6/13

The article is concerned with the microbiologic corrosion occurring in the fuel tanks of jet aircraft. A series of measures are noted which can be taken for detection of bacteria and fungi in fuels in order to prevent contamination of aircraft fuel tanks. The most important measure for contending with this problem appears to be constant checking on the condition of the fuel from the refinery through the tank farm to the fueling equipment at airports and in aircraft wing tanks. Author (TAB)

N71-11849# Brigham Young Univ., Provo, Utah. Dept. of Chemical Engineering.
QUENCHING OF SOLID PROPELLANT COMBUSTION Final Scientific Report, Mar. 1967 – Feb. 1970
Marvin Duane Horton and Ralph L. Coates Mar. 1970 60 p refs
(Grant AF-AFOSR-0896-67)
(AD-711436; AFOSR-70-1376TR) Avail: NTIS CSCL 21/9.2

This report presents a transient combustion model and its use in describing the quenching of burning solid propellants. The model combines the transient combustion model of Dennison and Baum with the emperically determined steady state burning rate relationship. Comparison with experiment shows that the model correctly describes the quenching process and also encompasses several effects that were previously unexplained. Author (TAB)

N71-11850# Frankford Arsenal, Philadelphia, Pa.
SPECTROPHOTOMETRIC DETERMINATION OF SULFATE IN PROPELLANTS AND NITROCELLULOSE
George Norwitz Aug. 1970 23 p refs
(AD-711884; FA-T70-10-1) Avail: NTIS CSCL 7/4

An accurate method is proposed for the determination of sulfate in propellants and nitrocellulose that requires only 45 minutes. The sample is treated with a mixture of nitric acid, perchloric acid and magnesium nitrate, and the solution is evaporated to dryness over a Bunsen burner. The salts are heated for 5 minutes with a mixture of hydriodic, hypophosphorous and hydrochloric acids in a simplified distillation apparatus while passing nitrogen through the system, the hydrogen sulfide which results from the reduction of sulfate is absorbed into ammonium hydroxide, lead citrate is added, and the brownish-yellow lead sulfide color is measured. Author (TAB)

N71-11876# Air Force Systems Command, Wright-Patterson AFB, Ohio. Aero Propulsion Lab.
AN EVALUATION OF THE STATIC CHARGE REDUCER FOR REDUCING ELECTROSTATIC HAZARDS IN THE HANDLING OF HYDROCARBON FUELS Summary Report, Jun. – Nov. 1969

Charles R. Martel Jul. 1970 43 p refs
(AD-712368; AFAPL-TR-70-22) Avail: NTIS CSCL 21/4

The report describes the results of an experimental evaluation of the Static Charge Reducer. The Static Charge Reducer is a device which automatically neutralizes an electrically charged fuel as the fuel flows through it. The tests conducted confirmed the claims that the Static Charge Reducer would reduce the charge density of a flowing hydrocarbon fuel to below 30 microcoulombs per cubic meter. The tests also indicate that two corrosion inhibitor fuel additives significantly affect the electrical conductivity of fuel containing the ASA-3 antistatic additive. Author (TAB)

N71-11880# Snia Viscosa, Colleferro (Italy).
THEORETICAL AND EXPERIMENTAL STUDIES OF A POLYURETHANE PROPELLANT HAVING A REDUCED BURNING RATE Final Report [ETUDES ET EXPERIENCES RELATIVES A L'OBTENTION D'UN PROPERGOL AU POLYURETHANE AYANT UNE VITESSE DE COMBUSTION REDUITE Rapport Final]
[1970] 108 p In FRENCH
(Contract CTR-17-6-31)
(GSR/CSE/55) Avail: NTIS

Several compositions were examined and tested for qualifying a polyurethane-based apogee engine propellant. The effect of several additives on the mechanical and ballistic properties was also studied and in some mixtures Parlon S20 was used as a retardant. ESRO

N71-11881# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.
EXTINGUISHMENT OF SOLID PROPELLANTS BY RAPID DEPRESSURIZATION
C. L. Merkle, S. L. Turk, and M. Summerfield Jan. 1970 220 p
(Contract Nonr-1858(32))
(AD-712116; AMS-880-S) Avail: NTIS CSCL 21/9.2

The document is a supplement to AD-697 661 and contains the detailed data from the extinguishment tests and complete descriptions of the computer programs referred to in that report. The data from 330 extinguishment tests include the measured pressure versus time histories (in tabular and graphical form), propellant designations and extinguishment parameters. Listings, descriptions and sample cases are included for two computer programs: Program to Calculate Constants in the Characteristic Time Equations for Chemical and Diffusional Processes and Program to Predict Extinguishment and to Calculate Dynamic Burning Properties from Pressure versus Time Data Input. TAB

N71-11889# Explosives Research and Development Establishment, Waltham Abbey (England).
THE BINDER/OXIDANT INTERFACE IN PLASTIC PROPELLANT
T. P. Hobin Sep. 1969 22 p refs
(AD-711269; ERDE-TR-10; TRC-BR-18126) Avail: NTIS CSCL 21/9.2

Contact angles have been measured between a number of organic liquids and flat, moisture-treated surfaces of ammonium perchlorate. The results indicate that a moist ammonium perchlorate surface is completely wetted by hydrocarbon liquids of srface tension less than 34.5 mN/m (34.5 dyn/cm), but the same surface after treatment with Surfactant S101 is completely wetted only by hydrocarbon liquids of surface tension less than 21.5 mN/m (21.5 dyn/cm). The displacement of one liquid by another on the surface of ammonium perchlorate has been investigated in respect of water and the various liquid ingredients of the propellant. The dependence of the physical properties of plastic propellant on the binder/oxidant interface is discussed, together with some aspects of the problem of propellant ageing. Author (TAB)

N71-11890# Army Mobility Equipment Command, Fort Belvoir, Va.
PROPOSED NUCLEAR MAGNETIC RESONANCE METHOD OF DETERMINING THE AROMATICITY OF HYDROCARBON FUELS
James V. Mengenhauser Jun. 1970 21 p refs
(AD-711892; USAMERDC-1983) Avail: NTIS CSCL 21/4

A new method of determining the aromaticity of hydrocarbon fuels is proposed. This method utilizes nuclear magnetic resonance spectroscopy to measure complexation of acceptor molecules by aromatic hydrocarbon donors in the fuel. Dichloromethane and nitromethane were found to be satisfactory acceptors for this purpose. Equations were developed for the general case of N different aromatic donors, each having a different concentration, equilibrium constant, and complexation shift and with the assumption of rapid chemical exchange of the acceptor among the N competing donors. For any unknown fuel, the acceptor shift is a precise, reproducible quantity which may be converted to volume per cent aromatics by means of a simple equation. The constants in this equation may be determined by standardization with any aromatic hydrocarbon or with any mixture of aromatics. The method is applicalbe to any liquid hydorcarbon fuel and, unlike many existing methods, is unaffected by olefins, dyes, and fluorescent compounds. The precision of the shift measurement is typically 0.4 Hz, which corresponds to 0.2 - 0.5 percent aromatics. Author

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N71-11464*# Electro-Optical Systems, Inc., Pasadena, Calif.
STUDY AND DESIGN OF A CESIUM BOMBARDMENT ION ENGINE SYSTEM Final Report, Apr.-Aug. 1970
R. M. Worlock and G. Grant Sep. 1970 23 p refs
(Contract NAS5-21174)
(NASA-CR-111381; EOS-4055F) Avail: NTIS CSCL 21C

The feasibility of designing a cesium bombardment ion engine system whose control logic and power conditioning subsystem is based on welded electronic modular construction was studied. System specifications and designs were based on a one millipound thrust system. A number of significant improvements in circuit design were developed, tested, and incorporated into the system design. The welded module approach to electronic packaging was found to be advantageous and was utilized in carrying out the system design. Author

N71-11467*# Purdue Univ., Lafayette, Ind. Jet Propulsion Center.
AN INVESTIGATION OF NONEQUILIBRIUM EFFECTS ON COMBUSTION IN SUPERSONIC STREAMS
R. M. Jensen, C. A. Bryce, and B. A. Reese Aug. 1970 233 p refs
(Grant NGR-15-005-013)
(NASA-CR-111371) Avail: NTIS CSCL 21D

A gas generator burning nitrogen tetroxide and hydrazine, plus a nitrogen diluent was employed to produce the vitiated air which had approximately 19% by weight of water, replacing an equal volume of nitrogen in real air, 26% oxygen and 55% nitrogen. Test section conditions simulated a free flight Mach number of 6.5 and an altitude of 80,000 ft. The composition of the entering streams and the composition variation with time during ignition were derived and ignition delays were calculated using a one-dimensional, reacting gas program which assumed constant temperature during the delay period. Subsequent analysis for vitiated air at specific experimental conditions investigated showed that hydrogen would ignite approximately 1.5 in. downstream of the injection station, and that if both streams (hydrogen and vitiated air) were in chemical equilibrium prior to mixing, the ignition would take place approximately 12 in. from the point of injection. Thus, the nonequilibrium free-radical content of the incoming streams tends to accelerate the ignition process to a significant degree. The ignition delay length was determined visually from high speed motion pictures of the exhaust flow. The results showed the ignition delay distance to be a direct function of the hydrogen injection temperature. Author

N71-11626# Advisory Group for Aerospace Research and Development, Paris (France).

ADVANCED TECHNOLOGY FOR PRODUCTION OF AEROSPACE ENGINES

Sep. 1970 318 p refs Presented at the 35th Meeting of the AGARD Propulsion and Energetics Panel, London, 6–10 Apr. 1970
(AGARD-CP-64) Avail: NTIS

Conference papers are presented on the following areas of research: engine manufacturing technology and design, materials, test techniques, new manufacturing techniques, and influence of advanced technology on engine accessories. For individual titles see N71-11627 through N71-11654.

N71-11630# Messerschmitt-Boelkow G.m.b.H., Munich (West Germany).

ADVANCED ROCKET THRUST CHAMBER TECHNOLOGY

H. Dederra *In* AGARD Advanced Technol. for Production of Aerospace Eng. Sep. 1970 6 p (See N71-11626 02-28)
Avail: NTIS

An advanced thrust chamber concept is presented. The chamber body consists of OFHC copper. The inner and outer contours of the chamber body are manufactured by duplicate-turning. The coolant passages are milled on the chamber body's outer periphery in an axial direction. The outer shell covering the coolant passages is electroplated. This concept has demonstrated its feasibility for regenerative cooling of very high chamber pressures at extremely low coolant pressure drops. The application of high-pressure propulsion systems for future space programs will result in considerable increase of payload and hence reduction of payload-cost. Author

N71-11631# Air Force Systems Command, Edwards AFB, Calif. Air Force Rocket Propulsion Lab.

TRENDS IN THE FABRICATION OF LIQUID ROCKET THRUST CHAMBERS

Carlton D. Penn *In* AGARD Advanced Technol. for Production of Aerospace Eng. Sep. 1970 15 p refs (See N71-11626 02-28)
Avail: NTIS

Virtually all liquid propellant rocket engines manufactured in the United States have utilized tubular construction for the regeneratively cooled thrust chamber. This method has been recognized to have several disadvantages, including high cost and limited design choices. Other fabrication techniques are now becoming important because of their capability to overcome the limitations imposed by tubes. These techniques generally consist of some method of forming a thrust chamber wall, provision for coolant passages in this wall, and finally, a method of closure and structural support. One of the most useful of these methods is electroforming, which is frequently used for the closure, but can also be used for fabrication of the complete thrust chamber. Spinning from flat sheets is a very attractive method for forming the thrust chamber wall because it is low cost, applicable to a large number of materials, and results in very good material properties. Other methods which are extremely interesting because of their low cost are investment casting and powder metallurgy. Experimental investigations have demonstrated the applicability of these and other methods to thrust chamber fabrication. Some of these methods are now being considered for new engine systems, and it is likely that their use will increase. Author

N71-11653# Rolls-Royce, Ltd., Bristol (England). Olympus 593 Design Office.

THE INFLUENCE OF THE CONCORDE POWERPLANT OPERATING CONDITIONS ON THE DESIGN OF THE OLYMPUS 593 FUEL AND OIL SYSTEM

R. J. Symon *In* AGARD Advanced Technol. for Production of Aerospace Eng. Sep. 1970 8 p (See N71-11626 02-28)
Avail: NTIS

The nacelle configuration and engine operating conditions have had a major effect on the design of the Olympus 593 Engine for the Concorde aircraft. At the cruise condition there is an airflow of 12 lbs/sec. over the outside of the engine, through the engine bay, varying in temperature from 115 C at the front of the engine to 180 C at the rear. The fuel temperature can vary from −54 C to 160 C and the oil temperature from −54 C to over 200 C. With the economics of the Concorde demanding high aircraft utilization, and the possible hazardous effects of fuel leakage, it was obvious at the start of the project that a high standard of piping and sealing technology was required. It is the purpose of this paper to describe some of the areas to which particular attention is being paid to realize this objective. Author

N71-11677*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Propulsion Div.

SATELLITE AUXILIARY-PROPULSION SELECTION TECHNIQUES

Lee B. Holcomb 1 Nov. 1970 143 p refs
(Contract NAS7-100)
(NASA-CR-111403; JPL-TR-32-1505) Avail: NTIS CSCL 21H

In order to establish criteria for the selection of attitude and station keeping propulsion systems for future satellites and other unmanned spacecraft, current auxiliary propulsion systems were surveyed and parameterized. Thruster systems considered were inert gas, monopropellant hydrazine, vaporizing liquid, electrolysis, Tridyne, resistojet, radioisojet, and subliming solid. Electrostatic and electromagnetic thrusters were also surveyed, but were not included in the detailed study. A generalized auxiliary propulsion system selection technique, based on cost effectiveness criteria, is presented. Three specific missions are included as examples of the use of the selection criteria: a synchronous satellite, a subsynchronous satellite, and a Grand Tour planetary spacecraft. Author

N71-11678# Illinois Inst. of Tech., Chicago.

ANALYTICAL AND EXPERIMENTAL INVESTIGATIONS OF OSCILLATIONS IN ROCKET MOTOR BAFFLE CAVITIES

Final Scientific Report
T. Paul Torda Jun. 1970 71 p refs
(Grants AF-AFOSR-1516-68; AF-AFOSR-1081-66)
(AD-711420; AFOSR-70-1957TR) Avail: NTIS CSCL 21/8.1

Secondary flows induced in cavities with triangular cross-sections, due to an airflow over the mouth of the cavities, were investigated. Two cavities, having apex angles of 30 degrees and 60 degrees, were considered. Flow patterns were obtained for various depths of these cavities. Periodic oscillations were found to exist in the shear layer at the mouth of the cavity. An empirical correlation was obtained between the frequencies of these oscillations and the physical dimensions of the cavity. Additional experiments were carried out for shock excitations of variable depth cavities using a 21 ft. shock tube of rectangular cross-section. Author (TAB)

N71-11879# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.

SPECTROSCOPIC MEASUREMENTS OF NITRIC OXIDE IN SPARK IGNITION ENGINES

George A. Lavoie Mar. 1970 41 p refs Sponsored in part by Sloan Basic Res. Fund *Its* Publ. No. 70-4
(PB-192625) Avail: NTIS CSCL 21B

The formation of nitric oxide in a spark ignition engine was monitored by means of time resolved measurements of the NO + O recombinations continuum. The results of the experiment show that the bulk of nitric oxide production occurs in the burned gas and that the contribution of the flame zone is negligible over the range of equivalence ratios 0.85 < or + or − theta < or + or − 1.1 and for normal engine conditions. The measurements compare favorably with calculations based on a previously developed kinetic model and show that for the purposes of engine studies, nitric oxide formation can be adequately described by an extended Zeldovich mechanism. Author (USGRDR)

N71-11882*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ACOUSTIC AND AERODYNAMIC PERFORMANCE OF A 6-FOOT-DIAMETER FAN FOR TURBOFAN ENGINES. 2: PERFORMANCE OF QF-1 FAN IN NACELLE WITHOUT ACOUSTIC SUPPRESSION

Arthur W. Goldstein, James G. Lucas, and Joseph R. Balombin Washington Nov. 1970 92 p refs
(NASA-TN-D-6080; E-5757) Avail: NTIS CSCL 21E

This fan, designed for low-noise output, produced significantly less perceived noise at take-off and approach conditions than fans in current use. Measured broadband noise varied with speed but not with aerodynamic blade loading. Multiple pure-tone noise was present at 80 percent of design speed and above and at 90 percent of design speed was strongly dependent on loading. Blade-passing tone noise contributed substantially to noise radiation in front of the fan, but very little rearwards. At 90 percent of design speed, this noise component varied strongly with loading in a manner opposite to the loading variation of the multiple pure tones. Author

N71-11884*# Aerojet Liquid Rocket Co., Sacramento, Calif. Thrust Chamber Engineering Section.

ACOUSTIC LINER FEASIBILITY PROGRAM, DESIGN GUIDE

19 Apr. 1970 245 p refs
(NASA-CR-111405; Rept-8852-DG) Avail: NTIS CSCL 21H

Guidelines for the use of engineers in designing combustion stability control devices are presented. High frequency or acoustic modes of combustion instability are considered, and theories for correlating storable liquid rocket injector design parameters with high frequency combustion instability are analyzed. The basic topics discussed for designing acoustic liners for ablative chambers are: (1) acoustic damping, (2) heat transfer, and (3) materials and structures. An annotated bibliography is included. F.O.S.

N71-11885*# Aerojet Liquid Rocket Co., Sacramento, Calif.

BIPROPELLANT VALVE IMPROVEMENT PROGRAM APOLLO SERVICE PROPULSION SYSTEM ROCKET ENGINE. GUIDE FOR BIPROPELLANT VALVE DESIGN

Jun. 1970 54 p refs
(Contract NAS9-8317)
(NASA-CR-111407; Rept-8317-D) Avail: NTIS CSCL 21H

The results of the bipropellant valve program are compiled with emphasis on the application of these results to valves in general. It has been found that the specific application requirements as well as basic design characteristics of various valve types control the design of valves. The approach has been to discuss design goals and requirements from a general viewpoint. Included are: (1) generalized propellant valve design criteria along with recommended practices; (2) discussion of commonly encountered practical development problems, effects on design and recommendations for solutions; (3) a review of experience in propellant valve design, manufacturing and test; and (4) a discussion of tradeoff analysis along with the tradeoff analysis conducted as a part of the bipropellant valve improvement program. A complete list of references and a bibliography are included. Author

N71-11886# Lockheed Missiles and Space Co., Sunnyvale, Calif. Propulsion Systems Dept.

SYSTEM STUDY OF ELECTROSTATIC COLLOID PROPULSION Final Report, 3 Nov. 1969 – 18 Sep. 1970

William H. Cutler 18 Sep. 1970 116 p
(Contract F33615-70-C-1074)
(AD-712114; LMSC-A977515) Avail: NTIS CSCL 21/3

This study illuminates problems to be encountered when electrostatic colloid propulsion is integrated with operational spacecraft. The study method is to hypothetically apply colloid propulsion to four spacecraft: Program 191, a spinning satellite; Low Altitude Surveillance Satellite on which the colloid system performs drag make-up; ATS-G which exposes problems of compatibility with a complex experimental spacecraft; and Program 621-B which provides opportunity to study a multi-function, multi-thruster system. The study was conducted in three main tasks with the following conclusions: In comparison with alternate forms of propulsion, colloid propulsion is flexible in its adaptability to a variety of missions for which its low thrust, high specific impulse, and low power are uniquely suited; the impact on the development program of a spacecraft using colloid propulsion is that time spans need not be expanded provided that adequate effort is expended in planning and testing to insure proper integration; attention must be given to interface interactions between the colloid system and most other spacecraft equipment items. Author (TAB)

N71-11887*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

SERVICE PROPULSION SYSTEM FINAL FLIGHT EVALUATION: APOLLO 8 MISSION REPORT, SUPPLEMENT 4

R. J. Smith Aug. 1970 58 p refs Prepared by TRW Systems
(Contract NAS9-8166)
(NASA-TM-X-66476; TRW-11176-H178-R0-00) Avail: NTIS CSCL 21H

The results of the post-flight analysis of the Service Propulsion System (SPS) performance during the Apollo 8 Mission are presented. The primary objective of the analysis was to determine the steady-state performance of the SPS under the environmental conditions of actual space flight. This report is mainly concerned with the analysis of the SPS steady-state performance. The following items are the major additions to, or changes from the results previously reported: (1) The performance values for the second SPS burn are revised. (2) The performance analysis of fourth burn was completed and the results are presented. (3) The analysis techniques, problems and assumptions are discussed. (4) The flight analysis results are compared to the preflight predicted performance. (5) The pressurization system performance is discussed in greater depth. (6) The transient data and performance for the third burn are included. Author

N71-11911*# Aerojet Liquid Rocket Co., Sacramento, Calif.

LOW COST TURBOPUMP STUDY Final Report, 30 Jun. 1969 – 13 Feb. 1970

M. W. Young 17 Jul. 1970 485 p refs
(Contract NAS8-24859)
(NASA-CR-102922; ALRC-2100-4) Avail: NTIS CSCL 21H

A methodology was developed for synthesizing lowest over-all cost turbopumps, which means that turbopump resulting in the lowest cost for a particular mission. This was done by examining the extent as well as manner that turbopump requirements affect over-all costs, investigating the technological level of cost-contributing operations, and evaluating the effect of this technological level upon over-all costs. The results then were utilized to evolve an optimal conceptual design of a selected turbopump configuration, along with preliminary planning for the development, production, and acceptance of the turbopump. The overwhelming conclusion from the study results is that a relaxation in requirements to reduce turbopump costs is not a fruitful way to decrease program costs. In effect, the potential exists for reducing turbopump program costs by as much as 40% (or 200-million dollars) through the appropriate tightening of design requirements to a degree that would permit acceptance test operations to be eliminated. Additionally large over-all program cost reductions could be accrued through this approach because of the cost sensitivity to engine performance. Author

N71-12035*# Pratt and Whitney Aircraft, East Hartford, Conn.
DEVELOPMENT OF MAINSHAFT SEALS FOR ADVANCED AIR BREATHING PROPULSION SYSTEMS, PHASE 2 Final Report
V. P. Povinelli and A. H. McKibbin 23 Jun. 1970 122 p refs
(Contract NAS3-7609)
(NASA-CR-72737; PWA-3933) Avail: NTIS CSCL 21E

Two mainshaft face seal configurations for advanced gas-turbine engines were designed, fabricated, and tested. The seal concepts incorporated lift geometries which used the relative motion between the primary seal surfaces to provide positive separation (film lubrication). One design (self-acting) with shrouded Rayleigh step lift pads operated with a gas film separating the sealing faces. The other design (hydrodynamic) with a spiral groove geometry operated with oil-film separation. Tests of the gas-film seal demonstrated the feasibility of operation at gas temperatures to 1200 F, pressure differentials to 250 psi, and sliding speeds to 450 ft/sec. Excellent correlations with analytically predicted performance parameters were obtained. Face wear was less than 0.1 mil after 320 hours at an air temperature of 1000 F, a pressure differential of 200 psi, and a sliding speed of 400 ft/sec. Average air leakage during that test was 14 scfm. These operating conditions exceed the capability of conventional contact seals and the air leakage is 1/10 that of a labyrinth seal. Testing of the oil-film seal revealed an inadequate seal force balance. Author

N71-12076*# Electro-Optical Systems, Inc., Pasadena, Calif.
COLLOID THRUSTER TECHNOLOGY Interim Report, 20 Jun. 1969 – 20 Jun. 1970
20 Jun. 1970 134 p refs
(Contract NAS5-21025)
(NASA-CR-111417) Avail: NTIS CSCL 21C

The feasibility of the annular geometry design (as opposed to capillary needle geometry) for the future development of a colloid thruster system composed of a simplified array of emitters is discussed. In addition to demonstrating this feasibility, the annulus has shown reproducible operation over a wide range of performance levels at high efficiencies with no glow discharge and very low extractor currents. This was attained by means of a coupled experimental/analytical investigation and carefully designed experiments on temperature, mass flow, beam configuration and glow discharge effects. The analytical study resulted in a set of equations that describe the interrelation of the operational parameters, thrust, specific impulse, specific charge and current and their variations with control variables, voltage and mass flowrate. Author

N71-12096*# TRW Systems Group, Redondo Beach, Calif. Science and Technology Div.
INVESTIGATION OF THRUSTERS FOR CRYOGENIC REACTION CONTROL SYSTEMS, VOLUME 1 Final Report, Jun. 1968 – Oct. 1969
R. J. Johnson 13 Nov. 1970 237 p
(Contract NAS3-11227)
(NASA-CR-72784; TRW-09849-6001-R0-00-Vol-1) Avail: NTIS CSCL 21H

An experimental and analytical program was conducted to evaluate the ignition characteristics and delivered performance of gaseous hydrogen oxygen reaction control thrusters. Specific goals were to establish design criteria for a pilot bed catalytic igniter and to define an operating map for reliable thruster ignition at two chamber pressure levels. The relative activities of Shell 405 and Engelhard MFSA catalysts at cryogenic temperatures were determined by both laboratory investigations and test hardware reactor firings. Repeatable ignitions, high performance, and pulse mode operation of each pressure level thruster were demonstrated with propellant temperatures from ambient to −250 F (117 K). Author

N71-12097*# TRW Systems Group, Redondo Beach, Calif.
INVESTIGATION OF THRUSTERS FOR CRYOGENIC REACTION CONTROL SYSTEMS. VOLUME 2: APPENDICES Final Report
R. J. Johnson 13 Nov. 1970 222 p refs
(Contract NAS3-11227)
(NASA-CR-72785; TRW-09849-6002-R0-00-Vol-2) Avail: NTIS CSCL 21H

For abstract see N71-12096

N71-12159# Purdue Univ., Lafayette, Ind.
MANIFOLD FILLING IN A VACUUM ENVIRONMENT Final Report, Nov. 1968 – Jun. 1970
Clark W. Hawk and John R. Osborn Edwards AFB, Calif. AFRPL Jul. 1970 152 p refs
(Contract F04611-69-C-0030)
(AD-712063; AFRPL-TR-70-76) Avail: NTIS CSCL 21/8.1

The report discusses an investigation to examine the effects of fluid properties, hardware design, and hardware operating conditions upon a manifold filling transient in a vacuum. A literature search was used to identify the important variables and dimensional analysis used to arrange them into dimensionless groups. This approach served to reduce the number of test variables and enhance the generality of the experimental results. The number of dimensionless groups was further reduced through analysis and physical reasoning. An experimental program was conducted using water and Freon-12 flowing into a manifold of simple geometry. The important independent dimensionless groups were identified and a physical model postulated. Author (TAB)

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N71-11143# Alaska Univ., College. Geophysical Inst.
TELLURIC, GEOMAGNETIC, AND AURORAL ACTIVITY ON ARCTIC DRIFTING STATIONS AND AT POINT BARROW Final Report, 1 Jun. 1959 – 30 Jun. 1969
Victor P. Hessler Jun. 1970 189 p refs
(Contract Nonr-3010(01))
(AD-711679; UAG-R-212) Avail: NTIS CSCL 4/1

The report presents results of scaling and analysis of telluric, magnetic and auroral data taken at Point Barrow, and on Arctic drifting stations Charlie, Arlis 1 and Arlis 3. Scalings of hourly range in telluric current activity for Point Barrow are presented for the epoch August 1961 through December 1965. Similar scalings are presented for the 2 to 4 month data recording periods for each of the three drifting stations. Studies of the diurnal variation of telluric current activity with respect to the auroral oval show relatively good correlation. However, the differences suggest the need for more study in relating the telluric activity to the auroral activity and, perhaps, in the delineation of Akasofus approximate auroral ovals. The relative amplitude of telluric activity at College, Barrow and Charlie is in the order of 13 to 5 to 1. Author (TAB)

N71-11145# California Inst. of Tech., Pasadena. Radio Observatory.

SYNTHESIS OF THE POLARIZATION PROPERTIES OF 3 C10 AND 3 C58 AT 1420 AND 2880 MHz

K. W. Weiler and G. A. Seielstad 1970 57 p
(Contract N00014-67-A-0094-0008)
(AD-711611; Rept-1970-6) Avail: NTIS CSCL 3/2

An earth-rotation aperture-synthesis technique was combined with the methods of interference polarimetry to study the total intensity and linear polarization properties of the two radio sources 3C10 and 3C58 with a resolution of approximately one minute of arc at both 1420 and 2880 MHz. These data were then used to calculate the distributions of spectral index, rotation measure, intrinsic position angle, and polarization for the sources. Author (TAB)

N71-11396# National Physical Lab., New Delhi (India). Radio Propagation Univ.

SOLAR AND GEOPHYSICAL DATA, PART 2

May 1970 16 p
(RRC-A179-Pt-2; SG-52) Avail: NTIS

Predicted and observed solar and geophysical data for April 1970 are presented in tables and graphs. The data include sunspot numbers, solar flux, solar flares and their effects, magnetic storms, and SID effects. Author

N71-11902# Air Force Cambridge Research Labs., Bedford, Mass.

PERIODIC FLUCTUATIONS IN FLUXES OF LOCAL RADIO-EMISSION SOURCES OF THE SUN

G. B. Gelfreikh et al 21 Aug. 1970 14 p refs Transl. into ENGLISH from Solnechnye Dannye (USSR), no. 9, 1969 p 88–94
(AD-712020; AFCRL-70-0490) Avail: NTIS CSCL 3/2

Fluctuations of solar radio emission at 4 cm were investigated using the radio interferometer with the small base. A construction of autocorrelation functions permits the detection of fluctuations with the periods of 10 to 15 min and more, and amplitude up to 0.5 to 0.7 percent of the undisturbed sun. It is shown that the periodic fluctuations are assumed to be due to proper oscillations of a coronal condensation - a condensed plasma, restricted by the magnetic field of the force lines rope in a sunspot group. Author (TAB)

N71-11903*# Scientific Translation Service, Santa Barbara, Calif.

TEST OF A SUPERCONDUCTIVE MAGNETIC SYSTEM WITH A FIELD OF H APPROXIMATELY EQUAL TO 20 kOe ON BOARD A SATELLITE [ISPYTANIYE SVERKHPROVODYASHCHEY MAGNITNOY SISTEMY S POLEM H PRIBLIZ. 20 KE NA BORTU ISKUSSTVENNOGO SPUTNIKA ZEMLI]

O. P. Anashkin et al Washington NASA Nov. 1970 16 p refs Transl. into ENGLISH from Kosm. Issled. (USSR), v. 7, Sep.–Oct. 1969 p 786–793
(Contract NASw-2035)
(NASA-TT-F-13402) Avail: NTIS CSCL 20C

Discussed is an experiment in which the use of a superconducting magnetic system in a magnetic analyzer of positrons and electrons in primary cosmic radiation was tested on board Cosmos-213. In-flight temperature and pressure measurements were performed in a helium container, while the magnetic field intensity was measured in the superconducting system. During the first six hours of the flight, the helium in the cryostat was in a two-phase state. After the appearance of an artificial gravitational force, produced by the rotation of the satellite, the temperature in the helium container began to increase rapidly, and the system passed to a single-phase state (supercritical state at a pressure of 2.4 atm). At the same time, the magnetic field in the superconducting system remained constant during the flight. Author

N71-11904# Aerospace Corp., El Segundo, Calif. Lab. Operations.

SOLAR ELECTRON ACCESS TO CLOSED FIELD LINES Technical Report, Feb.–Apr. 1970

Fred L. Vampola 25 Aug. 1970 29 p refs
(Contract F04701-70-C-0059)
(AD-712045; TR-0059(6260-20)-8; SAMSO-TR-70-352) Avail: NTIS CSCL 4/1

Solar electron fluxes, by virtue of their spectra, pitch-angle distributions, and temporal and spatial behavior, are used as test particles in investigating the quasi-trapping region of the geomagnetosphere. A number of features of these fluxes are demonstrated using data from magnetic electron spectrometers on the polar-elliptical orbiting satellite OV1-19 (1969-25C) during the period 12 April to 17 April 1969. The results indicate that although the particles are readily injected onto closed field lines, inward radial diffusion is slow compared with longitudinal drift and electrons do not become stably trapped in significant quantities unless the diffusion mechanism is an energy-dependent one in which low energy particles are preferentially diffused inward. Sharp persistent gradients between the quasi-trapped zone and the polar plateau (a region of uniform isotropic fluxes) are regarded as indicating there is an abrupt transition between a region of the geomagnetic field which consists entirely of closed field lines (i.e., permit conjugate point mirroring), and a second region in which the field lines either connect directly to the interplanetary field or extend into a tail which is very turbulent on the scale of the gyro-radius of .1 to 2 MeV electrons. Author (TAB)

N71-11921# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Electron and Plasma Physics.

MOTION OF CHARGED PARTICLES IN THE MAGNETOSPHERE

Carl-Gunne Faelthammar Aug. 1970 70 p refs Submitted for publication
(Rept-70-23) Avail: NTIS

A survey is given of charged particle motion in the magnetosphere, discussing perturbation theory, particle drift, influence of geomagnetic field, and adiabatic invariance, etc. ESRO

N71-11922# Aerospace Corp., El Segundo, Calif. Lab. Operations.

SPLITTING OF DRIFT SHELLS BY THE MANGETOSPHERIC ELECTRIC FIELD, APRIL–JUNE 1970

Michael Schulz and Juan G. Roederer (Denver Univ.) 15 Aug. 1970 18 p refs
(Contract F04701-70-C-0059; Grant NSF GA-3905)
(AD-712044; TR-0059(6260-20)7; SAMSO-TR-70-350) Avail: NTIS CSCL 4/1

The dawn-to-dusk magnetospheric electric field E breaks the pitch-angle degeneracy of particle drift shells in a magnetic-dipole field. For particles of sufficiently large kinetic energy T, the expression for the associated radial-diffusion coefficient is given. The coefficient of pitch-angle diffusion is roughly half the reciprocal lifetime. In the absence of pitch-angle scattering, the electric splitting of drift shells constitutes an important adiabatic phenomenon. Author (TAB)

N71-11923# Aerospace Corp., El Segundo, Calif. Lab. Operations.

THE OBSERVATION OF 3.3-mm BURSTS AND THEIR CORRELATION WITH SOFT X-RAY BURSTS, MARCH 1968–DECEMBER 1969

Fred I. Shimabukuro 3 Sep. 1970 28 p refs
(Contract F04701-70-C-0059)
(AD-711784; TR-0059(6230-30)-5; SAMSO-TR-70-331) Avail: NTIS CSCL 3/2

Observations of 3.3-mm bursts show that in most cases these bursts have slower rise times and are longer lived than the impulsive centimeter bursts. There is a good temporal correlation between the 3.3-mm and soft x-ray bursts, indicating that these bursts have their origin in the same thermal source mechanism, although these emissions may not arise from the same electrons. Author (TAB)

N71-11968*# Chicago Univ., Ill. Enrico Fermi Inst.

EVIDENCE FOR SOLAR FLARE PROTON INDUCED RADIOACTIVITY IN LUNAR SURFACE MATERIAL RETURNED BY APOLLO 11

H. R. Heydigger and Anthony Turkevich [1969] 7 p refs
Supported in part by NASA
(Contract AT(11-1)-1167)
(NASA-CR-111368; COO-1167-7) Avail: NTIS CSCL 03B

The values for the abundances of several radionuclides in eight lunar surface samples reported by the Preliminary Examination Team are discussed. A comparison of the radioactivity values with analogous data for stone meteorites suggests that energetic particles from the solar flare of 12 April 1969 may have produced most of the Co-56 observed. Author

N71-12006# Transtek Associates, Reading, Mass.

THE PENUMBRA AND THE CHANGES IN THE EFFECTIVE RIGIDITY OF THE GEOMAGNETIC COSMIC RAY CUTOFF WITH CHANGES OF THE PRIMARY SPECTRUM IN A QUIESCENT GEOMAGNETIC FIELD

L. I. Dorman et al 21 Aug. 1970 22 p refs Transl. into ENGLISH from Kosm. Luchi Sb. Statei (USSR), no. 8, 1967 p 158–167 Prepared for AFCRL
(AD-712344; AFCRL-70-0186; AFCRL-Trans-68) Avail: NTIS CSCL 4/1

The calculation is presented for the effective rigidity of the geomagnetic cutoff in the presence of the penumbra and the change in this rigidity according to detection of various components at geomagnetic latitudes of 30, 40, and 50 degrees. The calculations are made for satellite altitudes and in the atmosphere as follows: for the neutron component at an altitude of 10 km, at mountain levels, and at sea level; for the hard component at an altitude of 10 km, at sea level and underground at the depths of 3 and 7 meters water equivalent. Also found are the expected changes in the effective cutoff rigidity of various instruments for a quiescent geomagnetic field when primary variations occur as a result of chromospheric eruptions or various types of cosmic ray modulation effects. Author (TAB)

N71-12033# Columbia Univ., New York. Astrophysics Lab.

X-RAY DETECTOR DEVELOPMENT AND INVESTIGATION OF THE ENERGETICS OF CELESTIAL X-RAY SOURCES

Final Report, 1 Jun. 1969 – 31 May 1970
R. Novick Jun. 1970 8 p refs
(Grant AF-AFOSR-1785-69)
(AD-712098; AFOSR-70-2405TR) Avail: NTIS CSCL 3/1

The development of a system for the detection of ultra-soft X rays in the energy range 0.100 to 0.300 keV is reported herein. The system, using grazing incidence optics and thin window gas-flow proportional counters to filter and collect low energy X rays, was designed as the payload of an Aerobee sounding rocket. It was successfully flown, on February 13, 1970, to measure the absolute intensity of the diffuse X-ray background at 0.25 keV. Further work in X-ray polarimetry and especially the results of a rocket experiment in March 1969 to measure the polarization of the X-ray source Tau X-1 are discussed. Author (TAB)

N71-12048*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ON THE ORIGIN AND ISOTROPY OF THE COSMIC gamma-RAY FLUX BETWEEN 1 AND 6 MeV AND ITS IMPLICATIONS FOR FUTURE gamma-RAY INVESTIGATIONS

F. W. Stecker, J. I. Vette, and J. I. Trombka Nov. 1970 9 p refs Submitted for publication
(NASA-TM-X-65383; X-641-70-411) Avail: NTIS CSCL 04A

The alternative hypotheses of galactic and extragalactic origin of the observed cosmic Gamma ray flux between 1 and 6 MeV in the light of the most recent spectral information on cosmic Gamma rays at above 1 MeV are examined. Conclusions show the galactic origin hypothesis is extremely remote and that the 1 to 6 MeV flux is of extragalactic origin. It should thus provide a strong background upon which sources in this energy region will be superimposed. This necessitates the use of high resolution Gamma ray telescopes in order to study possible discrete sources in the 1 to 15 MeV energy region. Author

N71-12080# New South Wales Univ., Kensington (Australia).

THE SUPERNOVA REMNANT VELA-X

Douglas Keith Milne (M.S. Thesis) 1969 124 p refs Submitted for publication
Avail: NTIS

Radio and Optical observations are presented of the fairly large galactic radio complex Vela X, Y, and Z. The radio brightness distributions, obtained at four frequencies, indicate an open annular structure reminiscent of other supernova remnants. The variation of spectral index over the region is investigated and shows that the radiation is substantially nonthermal. A high resolution distribution of magnetic field direction is deduced from polarization measurements made at three frequencies. The optical spectra of two filaments in the region were obtained with the photoelectric spectrum scanner. Electron temperature stratification over the filaments was deduced from the intensity ratios between certain lines in these spectra. Indications are of a small size high temperature region with an electron temperature of 100,000 K, together with a much greater volume of cooler gas at 10,000 K. The former region is bright in the lines of O3 while the latter region is bright in the lower excitation lines of O2, N2, and H. The collisionally excited nature of these spectra confirms previous suggestions that this object is the remnant of a supernova. Author

N71-12115*# American Science and Engineering, Inc., Cambridge, Mass.

HARD X-RAY EXPERIMENT FOR ASTRONOMICAL NETHERLANDS SATELLITE (ANS) PROGRAM Final Report

1 Oct. 1970 125 p refs
(Contract NASw-2001)
(NASA-CR-111375; ASE-2527) Avail: NTIS CSCL 04A

The technical considerations and program management for the hard X-ray experiment are discussed. The experiment is planned to consist of two Bragg diffraction spectrometers to detect line emission from highly ionized atomic states, and two large area detectors to detect, analyze, and record X-rays and provide pointing error signal. The systems designs, ground support equipment, and testing program are discussed, and the program structure and management, and reliability and quality control programs are reviewed. Preliminary design drawings and PERT network are included. N.E.N.

N71-12117# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

MODELS OF THE TRAPPED RADIATION ENVIRONMENT. VOLUME 6: HIGH ENERGY PROTONS

James P. Lavine (Wolf Res. and Develop. Corp.) and James I. Vette Washington 1970 49 p refs

(NASA-SP-3024) Avail: NTIS CSCL 04A

A model environment of the fluxes of protons with energies above 50 MeV is presented for January 1969. The experimental data used were for the time period 1961 to 1966 and were concentrated between L = 1.20 and L = 2.40. An exponential spectrum was used for the model since it was found to be a more accurate representation of the data than a power law. The model agrees within a factor of two with almost all of the experimental data over most of B-L space. It is difficult to determine which part of the spread is due to real temporal fluctuations, and which is due to experimental uncertainties in either calibration or subsequent instrument behavior. A more sophisticated description of the proton environment is not warranted until the source of the spread in the experimental data is known. Author

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N71-11137# California Inst. of Tech., Pasadena. Owens Valley Radio Observatory.

NEUTRAL HYDROGEN ABSORPTION IN THE Irr2 GALAXY M82

M. Guelin and L. Weliachew 1970 20 p refs Submitted for publication

(Contract N00014-67-A-0094-0008)

(AD-711299; Rept-1970-7) Avail: NTIS CSCL 3/2

Absorption by neutral hydrogen has been detected in the galaxy M82. Measurements were carried out with the transit radio telescope at Nancay. Emission and absorption do not occur at the same velocities. The velocity and width of the absorption profile are in agreement with emission lines detected previously at optical wavelengths along the major axis and close to the center of the galaxy. The neutral absorbing gas is related to the noncircular motions near the center of the galaxy rather than to the rotation as derived from optical absorption lines. The neutral hydrogen temperature cannot be estimated because emission was not detected at the central absorption velocity. Author (TAB)

N71-11402*# Lincoln Lab., Mass. Inst. of Tech., Lexington.

RADAR STUDIES OF THE MOON Final Report

17 Sep. 1970 55 p refs

(Contract NAS9-7830)

(NASA-CR-108668) Avail: NTIS CSCL 03B

The experimental results are a set of highly resolved maps of the radar backscattering properties of the lunar surface, for the expected and the depolarized return, on a scale of about 2 km. The equipment and methods that were used are outlined. A section on the theory of radar backscatter provides the framework for the final section containing surface characteristic analyses of proposed and alternate Apollo landing sites. Author

N71-11403*# Michigan Univ., Ann Arbor.

OPTIMAL LOW THRUST ESCAPE VIEWED AS A RESONANCE PHENOMENON

Robert A. Jacobson and William F. Powers May 1970 22 p refs

(Grant NGR-23-005-329)

(NASA-CR-108665; Rept-02677-T-2) Avail: NTIS CSCL 22C

A complete second order perturbation solution to a modified optimal low thrust escape problem is presented. The optimal thrust direction is shown to be tangential to first order, and oscillatory to second order with period equal to that of the initial circular reference orbit. The improvement of the optimal trajectory over a tangential thrust escape trajectory is shown to be a second order resonance type effect. Author

N71-11414*# Texas Univ., Austin. Dept. of Aerospace Engineering and Engineering Mechanics.

POINCARE'S HYDRODYNAMIC ANALOGY IN CELESTIAL MECHANICS

V. Szebehely [1970] 11 p refs

(Grant NGR-44-012-132; Contract N00014-67-A-0126-0007)

(NASA-CR-111364; AD-696594) Avail: NTIS CSCL 03C

The analogy between the differential equations describing dynamical systems of two degrees of freedom on one hand and two and three dimensional flow on the other hand is investigated. Author (TAB)

N71-11415*# National Aeronautics and Space Administration. Washington, D.C.

INTRODUCTION TO EXPERIMENTAL TECHNIQUES OF HIGH-ENERGY ASTROPHYSICS

H. Oegelman, ed. and J. R. Wayland (Maryland Univ.), ed. 1970 259 p refs

(NASA-SP-243) Avail: NTIS CSCL 03B

Theories and experimental techniques of high energy astrophysics are developed. Topics involve interaction of gamma rays with matter as studied by energy spectra and chemical and isotopic composition. The principles of operation of several charged particle detectors are discussed and their methods of detection, based on the process of ionization or excitation of atoms in the detection medium, are outlined. Considered are X-ray detectors, astronomical photon detectors, cosmic ray detectors, and radio astronomical observations. G.G.

N71-11883*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

LUNAR SURFACE MINING: A REVIEW OF SOME MAJOR ENVIRONMENTAL CONSTRAINTS

Reynold Q. Shotts and Stanley A. Fields 20 Jul. 1970 43 p refs

(NASA-TM-X-64530) Avail: NTIS CSCL 22A

Selected environmental factors that will influence lunar surface mining operations are reviewed. The environmental factors and their influence on lunar surface mining tha are discussed are: (1) temperature, lunar surface, and lunar subsurface thermal problems; (2) atmosphere and pressure; (3) gravitational force; (4) problems of sun angle, latitude, and shadow; (5) composition and properties of the lunar surface and subsurface; and (6) selenology. The constraints of each environmental factors are summarized. Seven hypothetical ore deposit models are suggested, and calculations are made of the volume and mass of ore overburden that must be removed to supply an assumed annual demand for water on the moon. Author

N71-11894# California Inst. of Tech., Pasadena. Owens Valley Radio Observatory.

GALACTIC HYDROGEN ABSORPTION AT 21 cm WAVELENGTH IN THE DIRECTION VIRGO A

R. S. Colvin, M. P. Hughes, A. R. Thompson, and G. L. Verschuur 1970 18 p refs

(Contract N00014-67-A-0094-0008)

(AD-711300; Rept-1970-8) Avail: NTIS CSCL 3/2

The 21 cm optical depth in the direction of Virgo A is 0.017 plus or minus 0.003 near the velocity of the peak of the galactic background emission, and the corresponding gas temperature lies within the range 180 - 460 degrees Kelvin. In the negative-velocity wing of the emission profile the optical depth is less than 0.002 which indicates a minimum gas temperature of 600K. TAB

N71-11895# Minnesota Univ., Minneapolis. School of Physics and Astronomy.

INFRARED STUDIES OF THE LUNAR TERRAIN

David Anthony Allen (Ph.D. Thesis) 1970 150 p refs
(Rept-5) Avail: NTIS

An infrared study of the cooling behaviour of eclipse thermal anomalies during the lunar night is presented. At observing wavelengths of 11.6 and 21 microns, over 300 of them have been located and measured, most on several occasions. Some of the more intense hot spots have been observed at shorter wavelengths. A model for the thermal anomalies is proposed. Boulders on the Moon cool much more slowly than the average lunar surface, and calculations were made of their thermal behaviour. The results of these computations show the presence of large numbers of boulders in small regions of the Moon can fully explain all the observed properties of the hot spots, both at eclipse and during the lunar night. Studies of extremely high resolution Lunar Orbiter photographs of some thermal anomalies show boulders to be present within them in just the right numbers. The infrared observations also provide evidence that a scattering of boulders exists across almost the entire lunar surface, affecting measurements of the thermal characteristics of that surface. Author

N71-11896# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.

ON THE VISIBILITY OF A SATELLITE IN AN ELLIPTIC ORBIT

Hiroki Matsuo Sep. 1970 70 p refs *Its* Vol. 35, No. 12
(ISAS-454) Avail: NTIS

The probabilistic aspect of the visibility of earth satellites is studied, with its applications to communication satellites, navigation satellites, weather satellites, reconnaissance satellites and scientific satellites. A method to evaluate the visible probability of a satellite in an elliptic orbit from a ground station is proposed, where the visible probability is obtained as a function of the location of the station and the orbital elements such as a, e, i, and w. Monte Carlo simulations have been attempted to test the validity of the method, with quite satisfactory results. Also a method to evaluate graphically the average number of conjunctions is presented for the case of the elliptic orbit. With the emphasis upon the application to communication satellites, a method to calculate the mutual visibility of a satellite is also derived. As an example, optimum allocation of the satellites among the various orbits to cover a global communication network is discussed, using linear programming technique. The result shows that in some cases the elliptic system is advantageous over the circular one as to the number of the satellites required to assure a given level of link connectivity. Finally, problem of continuous coverage of a specified area of the earth is discussed. Also it has been found that there are cases where the use of the elliptic system is recommended. Author

N71-11917# Tokyo Univ., (Japan). Dept. of Space Science.

EXOSPHERIC TEMPERATURE OF VENUS

Mikio Shimizu Sep. 1970 11 p refs
(ISAS-455-Vol-35-No-13) Avail: NTIS

The local time dependence of the Cytherean exospheric temperature in the instantaneous heating rate model is calculated by solving the heat condition equation. It is found that the differential heating by the solar ultraviolet radiation produces steep temperature gradients near terminator, mainly due to the low exospheric temperatures at the night side. The large velocity wind system driven by this temperature field may play a role to explain the observed exospheric temperatures of Venus at sunlit and dark sides consistently with the scarcity of O atoms in the ionospheric region of this planet. Author

N71-11918*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

DETERMINATION OF MEAN ORBITAL ELEMENTS FROM INITIAL CONDITIONS FOR A VINTI BALLISTIC TRAJECTORY

Harvey Walden Washington Nov. 1970 13 p refs
(NASA-TN-D-6069; G-1001) Avail: NTIS CSCL 22C

A method previously proposed for the determination of mean orbital elements for Vinti's spheroidal theory of drag-free satellite motion directly from either initial conditions or Keplerian osculating elements is shown to be feasible for application to ballistic trajectories. The method, originally intended for use with multirevolution satellite orbits, is an iterative procedure involving a first-order Taylor's series expansion of position and velocity components at epoch time. The determination of mean orbital elements by this iterative method is shown to be a valid alternative to the factorization of two quartic polynomials that arise in the inversion of the integrals of motion and that are solved by successive approximations carried through second order in the earth's oblateness parameter. Numerical results for a ballistic trajectory are presented that demonstrate that convergence of the iterative fitting to initial conditions is rapid and exact. Author

N71-11919*# California Univ., Berkeley. Space Sciences Lab.

COMPARISON OF THE MEAN PHOTOSPHERIC MAGNETIC FIELD AND THE INTERPLANETARY MAGNETIC FIELD

A. Severny (Crimean Astrophys. Obs.), J. M. Wilcox, P. H. Scherrer, and D. S. Colburn (NASA, Ames Res. Center) 5 May 1970 26 p refs Submitted for publication *Its* Ser. 11, Issue 36
(Grant NGL-05-003-230; Contract N00014-69-A-0200-1016; Grant NSF GA-1319)
(NASA-CR-111406) Avail: NTIS CSCL 03B

The mean photospheric mangetic field of the sun seen as a star was compared with the interplanetary magnetic field observed with spacecraft near the earth. Each change in polarity of the mean solar field is followed about 4 1/2 days later by a change in polarity of the interplanetary field (sector boundary). The scaling of the field magnitude from sun to near earth is within a factor of two of the theoretical value, indicating that large areas on the sun have the same predominant polarity as that of the interplanetary sector pattern. An independent determination of the zero level of the solar mangetograph has yielded a value of 0.1 + or − 0.05 gauss. An effect attributed to a delay of approximately one solar rotation between the appearance of a new photospheric magnetic feature and the resulting change in the interplanetary field is observed. Author

N71-11928# European Space Research Organization, Paris (France). Dept. d'Astophysique.

THE STUDY OF MEAN RESOLUTION OF ULTRAVIOLET SPECTRA OF HOT STARS BETWEEN 1050 AND 3200 A [ETUDE A RESOLUTION MOYENNE DU SPECTRE UV DES ETOILES CHAUDES ENTRE 1050 ET 3200 A]

L. Houziaux, C. Jamar, and A. Monfils [1969] 30 p refs In FRENCH
(ESRO-SN-102; Rept-14) Avail: NTIS

The scientific experiment, S-116, is concerned with the study of the ultraviolet spectra of celestial bodies. The proposed system permits the obtaining of a resolution of 1.8 A with a relative point precision of roughly + or − 0.5 minutes. It also permits obtaining the star spectra of the visual magnitude 5-6 precisely or 2% for B type stars. The required point precision allows the utilization of a satellite to measure the possible mean size of the TD, class stars. Transl. by E.H.W.

N71-11929# Observatoire de Paris (France).

THIRD CATALOG OF ASTRONOMICAL TABLES OF DOUBLE STARS [TROISIEME CATALOGUE D'EPHEMERIDES D'ETOILES DOUBLES]

P. Muller and Cl. Meyer Sep. 1969 95 p refs In FRENCH
Avail: NTIS

Astronomical tables are given for double stars. Information covers star magnitude, distances and orbits. The tables cover the years 1950 to 1970. Transl. by E.H.W.

N71-11930# University Coll., London (England). Mullard Space Science Lab.

ASTROPHYSICAL INVESTIGATIONS AT THE MSSL

K. J. H. Phillips 1970 8 p refs Presented at the Brit. Interplanet. Soc. Symp. on Advanc. in Space Res. and Technol., London, Sep. 1970
Avail: NTIS

A general survey is given of the work done at Mullard Space Science Laboratory, London, in the fields of astrophysics, notably the fields of solar physics and cosmic X-ray astronomy. Author (ESRO)

N71-11933# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.

DIURNAL VARIATION OF MARTIAN EXOSPHERIC TEMPERATURE

Mikio Shimizu Sep. 1970 11 p refs *Its* Vol. 35, No. 14
(ISAS-456) Avail: NTIS

Diurnal variations of Martian exospheric temperatures at the times of Mariner 4, 6 and 7 observations are computed by solving the time dependent heat balance equations. It is found that steep temperature gradients exist between the day and night sides of this planet, mainly due to very low temperatures at the dark side where the infrared emissions from CO2 cool the atmosphere efficiently; these emissions produce a strong wind system in the Martian thermosphere. The adiabatic cooling of the atmosphere associated with this vertical wind helps in explaining the observed low exospheric temperatures at the sunlit side. This wind system also works to dilute the photochemical products such as CO and O at the dayside of the ionosphere. Author

N71-11951# Geological Survey, Washington, D.C.

STEPS TO THE MOON

GPO 1969 36 p
Avail: Issuing Activity

The steps man has taken to understand the moon are summarized briefly. Data obtained from the earliest studies to the present about the origins, structure, and composition of the moon are discussed. R.B.

N71-11952# European Space Research Inst., Frascati (Italy).

GRAVITATIONAL WAVES AND COSMOLOGY

Bruno Bertotti and Alfonso Cavaliere (MIT, Cambridge) [1970] 23 p refs Submitted for publication
Avail: NTIS

The strong bursts of gravitational waves suggest the presence in the galactic centre of a relativistic cluster of collapsed bodies which 'burns' its own gravitational potential energy and slowly decays into a dead, collapsed object. The possibility of this being a common feature throughout the universe is discussed and a simple cosmological model is considered in which the 'missing mass' is attributed mainly to gravitational waves and dead, dark galaxies. The production of the former is described by a simple rate equation containing a characteristic frequency alpha. Author (ESRO)

N71-11953# Royal Inst. of Tech., Stockholm (Sweden). Electron and Plasma Physics Div.

EXPLORING THE ORIGIN OF THE SOLAR SYSTEM BY SPACE MISSIONS TO ASTEROIDS

H. Alfven Jul. 1970 18 p refs
(Rept-70-26) Avail: NTIS

Theories on the sequence of processes, particularly the hetegonic processes, by which the solar system originated, are reviewed. Plasma physics, plasma chemistry, celestial mechanics, as well as space observations of small bodies such as asteroids, meteoroids, and comets, are basic for the reconstruction of the hetegonic problem. Future space programs are outlined with emphasis on missions directed to asteroids. ESRO

N71-11960# Royal Aircraft Establishment, Farnborough (England).

A PREP USERS MANUAL

R. H. Gooding May 1969 36 p refs
(RAE-TR-69104) Copyright. Avail: NTIS

PREP is a computer program for printing ephemerides of earth satellites, using the PROP analytical model which is based on Merson's mean orbital elements. A description of the program is given, with instructions on how to use it. Author

N71-11961# Queen Mary Coll., London (England). Dept. of Physics.

THE LUMINESCENCE OF LUNAR SAMPLES

J. A. Edgington and I. M. Blair (UKAEA, Harwell) 1970 6 p Presented at the Brit. Interplanet. Soc. Symp. on Advanc. in Space Res. and Technol., London, Sep. 1970
Avail: NTIS

Proton irradiation is used to determine the luminescent and thermoluminescent properties of lunar rocks from Apollo 11. ESRO

N71-11966# Boeing Scientific Research Labs., Seattle, Wash. Atmospheric and Planetary Sciences Lab.

DIRECTIONAL CHARACTERISTICS OF INFRARED EMISSION FROM THE MOON

D. F. Winter and J. A. Krupp Jul. 1970 35 p refs
(DI-82-0987) Avail: NTIS

Infrared surveys of the illuminated Moon have shown that the lunar surface does not radiate like a Lambert emitter. A detailed description is presented of directional emission from the equatorial region of the Moon, based on brightness temperature measurements by Saari and Shorthill. In general, the measurements indicate that the illuminated lunar surface is anomalously warm (cool) when the Sun is behind (in front of) the observer. It is plausible to attribute such directional effects to negative surface relief. A thermal model of a cratered lunar soil is developed to examine these effects both qualitatively and quantitatively. The results of the study indicate that centimeter- and meter-scale craters, with a variety of forms, both sharp and subdued, can account for measured directional emission characteristics over a wide range of Sun and observer angles. Author

N71-11967# Royal Greenwich Observatory, Herstmonceaux (England).

ROPER MOTIONS IN THE FIELD OF THE OPEN CLUSTER NGC 6939 ROYAL OBSERVATORY BULLETIN NO. 158

R. D. Cannon and A. G. Purcell 1970 14 p refs
Avail: NTIS; Royal Obs. 5s 0d NET

NGC 6939 has been examined in order to obtain a color-magnitude diagram for the cluster free from the influence of field stars; accordingly the investigation was limited to to the central region of the cluster. Using plates taken on the 60-inch reflector on Mount Wilson, relative proper motions have been determined for nearly all stars in a region approximately 16 minutes × 16 minutes centred on the cluster giving a total of 232 stars. Of these, 173 have been classed as possible cluster members. It was found that several stars lying near the main sequence well above the evolutionary turn-off point are probable members of the cluster; that the red giant branch extends beyond the concentration of stars to include a few much redder stars; and that probably a gap occurs in the evolved main sequence at its upper end. The proper motion of the cluster as a whole, which cannot be well determined since the number of field stars found is small, was close to that of its local standard of rest. Author

N71-12042*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

LUNAR LANDMARK LOCATIONS, APOLLO 8, 10, 11, AND 12 MISSIONS

Gary A. Ransford, Wilbur R. Wollenhaupt, and Robert M. Bizzell

Washington Nov. 1970 53 p ref
(NASA-TN-D-6082; MSC-S-249) Avail: NTIS CSCL 22A

Selenographic coordinates for craters that were tracked as landmarks on the Apollo lunar missions were determined. All known sources of error, such as gimbal-angle drifts and clock drifts, are accounted for by addition of the proper biases. An estimate of the remaining errors is provided. Each crater is described with respect to the surrounding terrain, and photographs of these craters are included. The total photographic coverage of these craters from the Lunar Orbiter and the Apollo missions is listed. Author

N71-12047# Liege Univ. (Belgium).
COMPUTED AND OBSERVED OI LINE PROFILES IN THE SPECTRA OF B3-A0 STARS
L. Houziaux [1970] 6 p refs *Its* Mons Astrophys. Papers No.11
Avail: NTIS

The sensitivity of computed profiles for the triplet at gamma 7772 to various atmospheric parameters, and the comparison of observed profiles (in bright stars) with computed ones are studied. Author

N71-12048*# Naval Research Lab., Washington, D.C.
[UPPER AIR PHYSICS, RADIO ASTRONOMY, AND ROCKET SPECTROSCOPY] Annual Report
Herbert Friedman 1970 69 p refs
(NASA Order W-13085)
(NASA-CR-111376) Avail: NTIS CSCL 03B

Discoveries and experimental results in upper air physics, radio astronomy, and rocket spectroscopy are presented. A brief discussion is given on instrument fabrication. The Solrad Aerobee, and the OGO-4 were used in the investigations. E.H.W.

N71-12153# Joint Publications Research Service, Washington, D.C.
ASTRONOMY
In its Soviet-Bloc Res. in Geophys, Astronomy, and Space, No. 238 13 Oct. 1970 p 1–3 refs (See N71-12152 02-34)
Avail: NTIS

News briefs and abstracts of articles are presented on radio interferometers with superlong bases, polarization of local radio emission sources,and simultaneous observation of compact radio sources by observatories in the United States and Soviet Union. R.B.

N71-12157# Joint Publications Research Service, Washington, D.C.
UPPER ATMOSPHERE AND SPACE RESEARCH
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 238, 13 Oct. 1970 p 23–37 refs (See N71-12152 02-34)
Avail: NTIS

News briefs are presented on the use of radar in circumlunar orbit, flight of the Luna 16 spacecraft, launching of Cosmos satellites, a seminar on the legacy and scientific writings of K. E. Tsiolkovskiy, and operation of Orbita ground station at Sovetskaya Gavan'. Abstracts of scientific articles are reported on temperature fields in spacecraft components with configuration of cylindrical shells, error in devices for sighting earth and lunar horizons, mathematical model of variations in atmospheric density at 30 to 80 km, auroral X-radiation at magnetic conjugate points, ordered motion of ionospheric ions at 600-km altitude, the probability of appearance of the Es layer over Dushanbe, ionospheric observations at Dushanbe during solar eclipse, measuring structural characteristics of coefficient of atmospheric refraction, chemical composition of Venusian atmosphere, and polar atmospheric parameters determined by luminescent method. R.B.

N71-12194# Academy of Sciences (USSR), Moscow.
USE OF SUCCESSIVE BRAKINGS IN THE PLANETARY ATMOSPHERE FOR TRANSFER FROM THE HIGH-ELLIPTICAL ORBIT TO A CIRCULAR ONE
P. E. Elyasberg and N. A. Eysmont 1970 44 p refs In ENGLISH and RUSSIAN
Avail: NTIS

Methods of translating spacecraft to low orbits are considered for the case when information about the atmosphere of the planet is incomplete and errors exist in the knowledge of orbital elements. It is assumed that the spacecraft is initially located in an orbit with high eccentricity. The gravitational field is considered to be central, and the planet and its atmosphere to be spherical nonrotating bodies. The lift-drag ratio of the satellite during flight in the atmosphere is assumed to be equal to zero and the value of the ballistic coefficient is taken as a constant. Under the given assumptions, the problem is one of analyzing the motion and control characteristics, using measurements of the load factor during motion in the atmosphere. The main sensor element of the control system is a motor switched on during the portion of flight outside the atmosphere. It is assumed that the control system can accomplish all necessary calculations during the time allotted, and besides the accelerometer data, can use available data about the orbital elements and characteristics of the planetary atmosphere. Transl. by R.B.

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N71-11702*# National Aeronautics and Space Administration, Washington, D.C.
EARTH ORBITAL PAYLOAD PLANNING
William O. Armstrong *In its* Space Process. and Manufacturing 21 Oct. 1969 p 10–40 (See N71-11701 02-15)
Avail: NTIS CSCL 22A

Processing and manufacture of materials in orbit is shown as one of the more promising elements of future earth orbital payloads. Plans for including it in the experiments program of the next decade are outlined and compared with preliminary planning for flight programs in this period. Space vehicles such as the AAP workshops, the space station and the shuttle are described and related to program planning for processing and manufacture of materials in orbit. Some of the major milestones in the evolution of such a program are also described. Industrial organizations will be responsible for a major part of this effort; therefore, procedures for soliciting and selecting industrial inputs are reviewed and some policy guidelines related to funding and proprietary rights of involved industrial organizations are considered. Author

N71-11897*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY RESULTS OF SERT 2. SPACECRAFT POTENTIAL MEASUREMENTS USING HOT WIRE EMISSIVE PROBES
Sanford G. Jones, John V. Staskus, and David C. Byers
Washington Nov. 1970 39 p refs
(NASA-TM-X-2083; E-5799) Avail: NTIS CSCL 22B

Data from the SERT 2 spacecraft were used to study the variation of spacecraft and ion beam potential with respect to space potential as a function of ion thruster and orbital parameters. Measurements were obtained using floating hot wire emissive probes. Spacecraft potentials of -6 to -11 V with the thruster not operating and -12 to -28 V with the thruster at maximum beam (253 mA) were obtained. The spacecraft potential variations were a function of orbital position. The effect, on spacecraft and ion beam potentials, of varying the ion thruster neutralizer to spacecraft potential was determined. The ion beam-neutralizer potential difference was found to be constant for spacecraft-space potentials from -77 to 0 V with constant neutralizer emission current. Radial potential profiles of the ion beam were also obtained for various spacecraft conditions. Author

N71-11898*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESCRIPTION OF SERT 2 SPACECRAFT AND MISSION
Richard G. Goldman, Guy S. Gurski, and William H. Hawersaat Washington Nov. 1970 25 p refs
(NASA-TM-X-2087; E-5807) Avail: NTIS CSCL 22B

A description of the SERT II spacecraft and its mission is presented. The mission purpose and the orbital flight plan to accomplish this purpose are discussed. The SERT II objectives are to prove the reliability and endurance capability of an ion thruster, develop and refine operational procedures, ascertain operating characteristics in the space environment, and validate ground test results. A mission objective of 6 months of continuous operation of one thruster system is expected to be achieved by a flight program stressing the use and application of reliable, space-proven components and design philosophies. Author

N71-11899*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO 10 RECOVERY FLASHING BEACON FAILURE, ANOMALY REPORT NO. 2
Aug. 1970 3 p
(NASA-TM-X-66485; MSC-02623) Avail: NTIS CSCL 09E

A postflight analysis was made to determine the cause for failure of the recovery flashing xenon lamp on Apollo 10. The results indicate that extended periods of lamp operation in the high flash-rate mode increase the temperature of the lamp such that thermally induced stresses due to differential expansion between the flash tube and its epoxy encapsulant crack the flash tube. D.L.G.

N71-11931# Royal Aircraft Establishment, Farnborough (England).
THE ORBIT OF 1968-59A, AND ITS USE IN UPPER-ATMOSPHERE RESEARCH
D. G. King-Hele Jan. 1970 25 p refs
(RAE-TR-70017) Copyright. Avail: NTIS

Accurate orbits of the high-drag satellite 1968-59A, which had an initial perigee height of 160 km, have been obtained at 9 epochs during its 117-day life with the aid of the R.A.E. orbit determination program PROP. All available optical and radar observations were used. On most of the orbits the perigee height has a standard deviation less than 0.4 km; for the longitude of the node and the inclination the average s.d. is 0.003 deg. The value of the inclination decreased from 89.888 initially to 89.75 deg just before decay, mainly due to the effect of atmospheric rotation, and by fitting a theoretical curve the following values were obtained for the atmospheric rotational speed, expressed as Delta times the earth's rotational speed: Delta = 1.20 + or − 0.07 at 170 km height; Delta = 1.1 + or − 0.1 at 150 km. Author (ESRO)

N71-11932*# National Aeronautics and Space Administration, Washington, D.C.
THE SPACE SHUTTLE: A NEW APPROACH TO SPACE TRANSPORTATION
L. E. Day 1970 57 p refs Presented at 21st Intern. Astronautical Congr., Constance, West Germany, 9 Oct. 1970
(NASA-TM-X-66388) Avail: NTIS CSCL 22B

State-of-the-art in Space Shuttle technology is reviewed, emphasizing the opportunities for broad international participation. Program objectives are specified and include the following: a less severe launch and reentry environment, opportunity for transport of non-astronaut personnel, flexible capability to support a broad spectrum of manned and unmanned payloads, significant reduction in the cost of payloads, and new earth orbital operations as well as support synchronous and planetary missions. E.M.C.

N71-11942# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
STOPWATCH OBSERVATIONS OF SATELLITES, APRIL 1970
R. D. Eberst 8 Jul. 1970 28 p
(ROE-STS-101) Avail: NTIS

Stopwatch observations made at stations connected with the Section during the month of April 1970 are listed in satellite launch order and in time order for each satellite. Various sub-totals are given. Author (ESRO)

N71-11943# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
STOPWATCH OBSERVATIONS OF SATELLITES, JUNE 1970
R. D. Eberst 21 Jul. 1970 19 p
(ROE-STS-103) Avail: NTIS

Stopwatch observations made at stations connected with the Section during the month of June 1970 are listed in satellite launch order and in time order for each satellite. Various sub-totals are given. Author (ESRO)

N71-11948# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
ORBITAL DEPLOYMENT OF VERY LONG TETHERED STRUCTURES
J. M. Whisnant, G. B. Bush, and C. J. Swet Jan. 1970 45 p refs
(Contract NOw-62-0604-C)
(AD-711945; APL-TG-1102) Avail: NTIS CSCL 22/3

Among the candidate configurations for future Radio Astronomy Explorer (RAE) spacecraft is a tethered orbiting interferometer consisting of two end bodies joined by a flexible cable several kilometers long. The system is launched as a single payload, then extended and gravitationally stabilized with its long axis nominally aligned with the local vertical. This paper presents some results of an inquiry into the feasibility of such a scheme, parametrically examining two potentially attractive in-orbit deployment techniques. The tether may pay out at near-zero tension to a preselected intermediate length, with librating capture and a subsequent deadbeat extension to remove the libration. With reel-back capability, payout under a controlled tension can proceed continuously to librationless capture at the intended final length. Boundary conditions are established, engineering problems are discussed, and possible applications to other missions are explored. It is concluded that practicable means of implementation can be developed with existing technology. Author (TAB)

N71-11949# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
WIND EFFECTS ON UNGUIDED ROCKETS FIRED NEAR MAXIMUM RANGE
Edward M. D'Arcy and Bernard F. Engebos Fort Monmouth, N.J. ECOM Jul. 1970 28 p refs
(AD-711854; ECOM-5317) Avail: NTIS CSCL 19/4

The response to wind of an unguided rocket to be fired near its maximum range capability is analyzed. It is demonstrated that both the range unit wind effects and the range wind-weighting factors become highly nonlinear with respect to the wind field, thus making the use of ordinary field techniques of impact prediction impractical. It is therefore, recommended that such rockets be fired in a real-time impact prediction mode. Author (TAB)

N71-11966# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
STOPWATCH OBSERVATIONS OF SATELLITES, MARCH 1970
R. D. Eberst 30 Jun. 1970 31 p
(ROE-STS-99) Avail: NTIS

Stopwatch observations made at stations connected with the Section during the month of March 1970 are listed in satellite launch order and in time order for each satellite. Various sub-totals are given. Author (ESRO)

N71-11969# Royal Aircraft Establishment, Farnborough (England).
THE ACCURACY OF THE VELOCITY INCREMENT VECTOR OF THE BLACK ARROW THIRD STAGE
A. P. Waterfall Aug. 1968 31 p refs
(RAE-TR-68207) Copyright. Avail: NTIS

The various sources of attitude errors in the Black Arrow third stage and their probable effect on the accuracy of the velocity increment vector were investigated. It is shown that apart from the possible but unknown effect of an impulse at motor ignition or of unstable burning, the directional error should be little more than 1 degree, which is well within the tolerances of an acceptable orbit. Author

N71-11998*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville Ala.
AS-508 S-4B POSTFLIGHT LUNAR IMPACT TRAJECTORY ANALYSIS
W. D. McFadden and I. M. Salzberg 9 Nov. 1970 117 p refs
(NASA-TM-X-64563) Avail: NTIS CSCL 22A

This document presents analyses of the AS-508 S-4B lunar impact. The lunar impact objective, a launch vehicle secondary objective, was to support the Apollo 12 passive seismic experiment by exciting the lunar structure upon impact and allowing the seismometer to record the event. In addition, an accurate postflight determination of the actual S-4B impact time and location was desired. The results of the analysis of the lunar impact, tracking data, trajectory and resulting lunar impact conditions are given. Included is a description of the current best estimate of the AS-508 lunar impact coordinates and a detailed trajectory listing from spacecraft separation to lunar impact. Author

N71-11999# Ministry of Technology, London (England).
EUROPEAN IMPLICATIONS OF THE AMERICAN SPACE TRANSPORTATION SYSTEM
N. Simmons 1970 15 p Presented at the Brit. Interplanet. Soc. Symp. on Advanc. in Space Res. and Technol., London, 16−17 Sep. 1970
Copyright. Avail: NTIS

A description is given of the proposed NASA space transportation system and the problems involved. After this, the possibilities of European participation in this program are discussed. ESRO

N71-12000# Centre National d'Etudes Spatiales, Paris (France). Div. 'Lanceurs.'
LAUNCHING VEHICLES FROM 1970 TO 1980 [LES LANCEURS DE 1970 A 1980]
C. Bigot 1970 26 p In FRENCH Presented at the Space Symp., Rennes, France, 16−19 Jun. 1970; sponsored jointly by CNES, Centre de Perfectionnement Tech., and Fac. des Sci. de Rennes
Avail: NTIS

Space exploration requires extremely powerful launchers and, depending on the aims, size, high performance or shuttle techniques may be chosen or combined. During the next decade Europe will limit herself to the development of launchers able to place in orbit medium-size synchronous satellites (400 to 700 kg), forerunners of semidirect television satellites. In addition France and the United Kingdom have developed a national launcher capable of placing in orbit small scientific packages (100 kg). In the U.S.A. in ten years time space shuttles will link the earth to the different orbiting space stations from where spaceships will leave for the different planets in the solar system. ESRO

N71-12001# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
STOPWATCH OBSERVATIONS OF SATELLITES, MAY 1970
R. D. Eberst 14 Jul. 1970 22 p
(ROE-STS-102) Avail: NTIS

Stopwatch observations made at stations connected with the Section during the month of May 1970 are listed in satellite launch order and in time order for each satellite. Various sub-totals are given. Author (ESRO)

N71-12031# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
STOPWATCH OBSERVATIONS OF SATELLITES, JULY 1970
R. D. Eberst 15 Sep. 1970 16 p
(ROE-STS-104) Avail: NTIS

Stopwatch observations made at stations connected with the Section during the month of July 1970 are listed in satellite launch order and in time order for each satellite. Various sub-totals are given. Author (ESRO)

N71-12041*# IIT Research Inst., Chicago. Astro Sciences Center.
SOLAR ELECTRIC PROPULSION FOR JUPITER AND SATURN ORBITER MISSIONS
A. Friedlander and R. Brandenburg Jul. 1970 162 p refs
Prepared for JPL
(Contracts NAS7-100; JPL-952701)
(NASA-CR-111422; IITRI-M-24) Avail: NTIS CSCL 22A

The characteristics and capabilities of solar electric propulsion (SEP) for performing orbiter missions at the planets Jupiter and Saturn are described. A set of four candidate missions comprising different orbit and payload selections is defined for each planet. These candidate missions provide a suitable basis for achieving a range of desired science objectives. The capabilities of the SEP flight mode are compared against those of the ballistic flight mode. Author

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N71-11126# Watervliet Arsenal, N.Y.
ELASTIC-PLASTIC ANALYSIS OF OPEN-END, TRANSVERSELY-ISOTROPIC TUBES UNDER INTERNAL PRESSURE. PART 1: DETERMINATION OF THE STRESSES
Peter C. T. Chen Jun. 1970 30 p refs
(AD-712303; WVT-7007) Avail: NTIS CSCL 20/11

The report contains an elastic-plastic analysis of a circular, open-end, unrestricted tube subjected to internal pressure of sufficient magnitude to cause plastic deformation. The axial stress is assumed to vanish identically throughout the tube. The material is homogeneous but transversely isotropic about the radius vector in both elastic and plastic regions. In the plastic portion, Hills orthotropic plasticity theory is used. Initial yielding for this problem will still start at the inner face. Expressions for the location of elastic-plastic interface and for the stress distribution are obtained, and the results are shown graphically. Author (TAB)

N71-11404*# Tennessee Technological Univ., Cookeville. Dept. of Engineering Science.
STRESS WAVES IN SANDWICH PLATES
Ray Kinslow and Brian Delano Aug. 1970 97 p refs
(Grant NGR-43-003-007)
(NASA-CR-108692; TTU-ES-70-3) Avail: NTIS CSCL 20K

A mathematical stress wave model is formulated for use in predicting the effects of various material combinations and geometry in the design of sandwich plates that may be subjected to high velocity impact. In the experimental investigations the bounding layers were of a birefringent material and stresses were determined by means of a dynamic polariscope utilizing a high-speed framing camera. A comparison is made of the theoretical and experimental results. Author

N71-11636# Societe Nationale Industrielle Aerospatiale, Paris (France).
APPLICATION OF CORRUGATED CORE SANDWICH STRUCTURES TO POWERPLANT COMPONENTS [L'EMPLOI DES STRUCTURES DU TYPE SANDWICH A AME ONDULEE DANS LES CONSTITUANTS DES UNITES MOTRICES]
A. Gozlan *In* AGARD Advanced Technol. for Production of Aerospace Eng. Sep. 1970 14 p refs (See N71-11626 02-28)
Avail: NTIS

In order to save weight and withstand increasingly stringent operating conditions, great use is currently made, in the construction of airframes and missiles, of new types of basic structure where matter is so distributed as to improve considerably the local stiffness. Such is the case with isotropic materials like honeycomb sandwich or orthotropic materials like corrugated core sandwich. The present paper deals with a material of the latter type made out of stainless or refractory metal sheet and its applicability to some components of power units. It is shown how this material can be used in the design of such selfcooled components as are internal insulating shrouds for combustion chambers of ramjet, turbo-ramjet and turbofan engines. Author

N71-11944# Admiralty Research Lab., Teddington (England).
STRUCTURAL DYNAMICS PROGRAMS
M. T. Murray May 1970 34 p refs Submitted for publication
(AD-711519; ARL/M/P28; NSTIC-26991) Copyright. Avail: NTIS CSCL 13/13

The report describes a set of KDF9 programs written over the past few years which calculate the dynamic behaviour of structures. Some of the programs are involved with the calculation of the mass and stiffness properties of structures, others with the calculation of resonant frequencies and modes and response to time-dependent forces, and others with the preparation of data and the analysis of results. Author (TAB)

N71-11945# Oxford Univ. (England). Dept. of Engineering Science.
FINITE-ELEMENT ANALYSIS OF ALTERNATING AXIAL LOADING OF AN ELASTIC PLATE PRESSED BETWEEN TWO ELASTIC RECTANGULAR BLOCKS WITH FINITE FRICTION
G. P. Wright and J. J. O'Connor 1970 33 p refs
(Rept-1107/70) Avail: NTIS

A method has been developed, making use of finite-element techniques, for calculating stress distributions, slip amplitudes, and damping capacities in a number of simple clamped joints under alternating loading conditions with a finite coefficient of friction on the interface. Typical results are given for one geometry. Author (ESRO)

N71-11946# Technische Hochschule, Darmstadt (West Germany). Inst. fuer Statik und Stahlbau.
TORSION-RESISTANT PRESTRESSED PERFORATED PLATES UNDER TRANSVERSE AND NORMAL LOADS IN THE SUPERCRITICAL REGION [TORSIONSSTEIFE, VORVERFORMTE GITTERROSTE UNTER QUER- UND NORMALKRAFTBEANSPRUCHUNG IM UEBERKRITISCHEN BEREICH]
Joachim Schubert (Ph.D. Thesis) 1969 182 p refs In GERMAN
Avail: NTIS

A method is developed, which allows for the calculation of thin, stiff, perforated plates under high deformative and compressive forces. The deformation and stress conditions of this problem are described by a nonlinear differential equations system, which is transformed into a nonlinear equations system. By linearization of the problem near the solution, the approximation method is iteratively improved through the method of the static indefinite differences. ESRO

N71-11950# National Aerospace Lab., Tokyo (Japan).
RESULTS OF STRAIN AND DEFLECTION MEASUREMENTS CARRIED OUT ON MODEL WINGS AND THEIR COMPARISON WITH CALCULATED RESULTS
1970 31 p refs In JAPANESE; ENGLISH summary
(NAL-TR-195) Avail: NTIS

Six model two-spar wings (three non-swept wings, two thirty degree swept wings, and one forty-five-degree swept wing with ribs perpendicular to the spars) were tested for strain distributions and deflections. Two model wings, jointed to a model center wing by bolts, were subjected to symmetrical loadings. Calculated strain distributions and deflections were obtained by the finite element method. Comparison with test results showed satisfactory agreement for the strain distributions. The comparison showed some difference for the deflections. Experimental error estimations are also described. Author

N71-11957# Indian Inst. of Science, Bangalore. Dept. of Aeronautical Engineering.
VIBRATION OF ORTHOTROPIC SKEW PLATES WITH DIFFERENT EDGE CONDITIONS
P. S. Nair and S. Durvasula Mar. 1970 18 p refs
(AE-267-S) Avail: NTIS

The vibration problem of orthotropic skew plates with different edge conditions involving simple support and clamping is considered using the Rayleigh-Ritz method with a double series of beam characteristic functions appropriate to the combination of the edge conditions. Results are presented for natural frequencies of orthotropic plates with one pair of opposite edges simply supported and the other pair clamped. Features such as frequency crossings, found in the case of isotropic and clamped orthotropic skew plates, are observed in the present case also. Author

N71-11968# Texas Univ., Austin. Engineering Mechanics Research Lab.
STRESS AND DEFLECTIONS IN TYPE 2 AND TYPE 4 AIRDROP PLATFORMS Final Report
Wen Shing Chang and E. A. Ripperger Natick, Mass. Army. Airdrop Eng. Lab. Dec. 1969 95 p refs
(Contract DAAG17-67-C-0189)
(AD-711556; TR-70-56-AD) Avail: NTIS CSCL 15/7

Severe stress conditions may develop during the extraction and parachute deployment phases of an airdrop with a stressed platform. The platform stresses and deflections during that dynamic loading period are computed by treating the platform as a planar network of beams rigidly connected at the joints. Stiffness properties of the beams in the network are calculated approximately using standard methods and then refined to more exact values by comparing measured deflections under static loading to computed deflections. These stiffness properties are then used in the analysis of the dynamic load. Equations of motion are written for each

degree of freedom using a lumped mass representation for the loads. Deflections at the joints of the network are obtained by solving the equations of motion using the Runge-Kurt-Gill numerical procedure. Stresses are then determined from the deflections.
Author (TAB)

N71-12012# Asian Inst. of Tech., Bangkok (Thailand).
UNIFORMLY LOADED ANNULAR SLABS SUPPORTED ON EQUALLY SPACED COLUMNS BETWEEN THE EDGES
Suthum Suriyamongkol (M.S. Thesis) 1970 47 p refs
(Rept-292) Avail: NTIS

The behavior of an annular slab supported on columns equally spaced along a circle between the edges and subjected to uniformly distributed load is investigated. A parametric study is carried out and the deflection and stress resultants are presented in the form of charts to facilitate the analysis and design of this type of structural element, e.g., an overhanging annular or full circular floor slab supported on columns, or an annular footing supporting a ring of columns provided that the bearing pressure of the soil is assumed to be uniform.
Author

N71-12013# Asian Inst. of Tech., Bangkok (Thailand).
BENDING OF A FULL CIRCULAR PLATE SUPPORTED ON TWO RINGS OF EQUALLY SPACED COLUMNS
Chi-Tso Chang (M.S. Thesis) 1970 46 p refs
(Rept-291) Avail: NTIS

A complete solution for the bending of a full circular plate supported on two rings of equally spaced columns and subjected to uniformly distributed load is presented. All limiting cases are investigated. Parametric studies are performed and the results are presented in the form of charts to facilitate the design of such structures.
Author

N71-12014# Asian Inst. of Tech., Bangkok (Thailand).
UNIFORMLY LOADED ANNULAR PLATES SUPPORTED ON COLUMNS ON ONE BOUNDARY AND SIMPLY SUPPORTED ON THE OTHER BOUNDARY
Ping Hsu (M.S. Thesis) 1970 35 p refs
(Rept-287) Avail: NTIS

The bending by uniform transverse load of an annular slab which is simply supported at the outer edge and column supported at the inner edge, or simply supported at the inner edge and column supported at the outer edge is studied. The problem is solved under the assumptions that the columns do not restrain the rotation of the slab, and that the column reactions are uniformly distributed over their width along the boundary. The influence of the column number, the column width, and the ratio of the radii is studied. The deflection and stress resultants are presented in charts and tables for design purposes.
Author

N71-12019# Asian Inst. of Tech., Bangkok (Thailand).
LONG RECTANGULAR PLATES SUPPORTED BY THREE PARALLEL ROWS OF EQUIDISTANT COLUMNS
K. M. Ashraful Alam (M.S. Thesis) 1970 58 p refs
(Rept-285) Avail: NTIS

The plates were subjected to (a) uniformly distributed load, (b) longitudinal line load and (c) transverse line load. The practical importance of such a structure is evident in the modern design of double bay buildings, raft foundations and elevated highways, where the elimination of beams and girders reduces the height of the structures. Of particular interest are the derivation of the particular integrals which allows the total solutions to satisfy the boundary conditions of the problem and the treatment of unequal column reactions. The columns are treated as finite line supports in order to alleviate the infinitely large values of the shear stress resultants due to point supports. Parametric studies are carried out and the results are presented to facilitate the design of such structures.
Author

N71-12020# Asian Inst. of Tech., Bangkok (Thailand).
OVERHANGING FULL CIRCULAR PLATE SUPPORTED ON COLUMNS
Felix Liu (M.S. Thesis) 1970 40 p refs
(Rept-288) Avail: NTIS

The problem is solved under the assumption that the columns do not restrain the rotation of the slab, and that the column reaction is a uniformly distributed line load along the ring. Some limiting cases are investigated and parametric studies are carried out. The results are presented in the form of charts to facilitate the analysis and the design of such structures.
Author

N71-12021# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
FOUNDATIONS AND BASES ON PERPETUALLY FROZEN GROUND
V. V. Dokuchaev 1970 164 p refs Transl. into ENGLISH from the Russian
(AD-711909) Avail: NTIS CSCL 13/13

The book sets forth practical methods of designing foundations on perpetually frozen soils. The first chapter contains brief information on the structural properties of frozen soils and ways to use them for bases for buildings, while the second and third chapters deal with methods of designing foundations on bases composed of frozen and thawing soils.
Author (TAB)

N71-12022# Royal Aircraft Establishment, Farnborough (England).
A MODIFICATION OF THE RAYLEIGH-RITZ METHOD FOR STRESS CONCENTRATION PROBLEMS IN ELASTOSTATICS
L. S. D. Morley Nov. 1968 19 p refs
(RAE-TR-68273) Copyright. Avail: NTIS

Details are given of a modification to the Rayleigh-Ritz method which, by extending the field of definition of the coordinate functions, improves the convergence in predicting the values of stress concentrations in elastic continua. The extension to the field of definition requires that the coordinate functions are not only complete in energy but also allows early derivatives of the displacement to be continuous. The procedure is described for three-dimensional inear elasticity and the problem of plate bending.
Author

N71-12023# Brown Univ., Providence, R.I. Div. of Engineering.
APPLICATION OF RITZ'S METHOD TO THIN ELASTIC SHELLS ANALYSIS
G. A. Dupuis Jul. 1970 37 p refs
(Contract N00014-67-A-0191-0006)
(AD-711962; TR-1) Avail: NTIS CSCL 13/13

The paper is concerned with finite element analysis of thin elastic shells described by the Koiter-Sanders mathematical model. The middle surface of the shell is decomposed into curved finite triangular elements, which are mapped onto straight triangles in the plane of parameters of the surface. We show that with an appropriate approximation of the given surface, rigid-body motions may be represented exactly. Nine degrees of freedom are associated with each nodal point (the vertices of the elements) and the displacement functions fulfill the conditions of regularity required by Ritzs method and assure convergence in energy. The derivation is quite general with respect to the geometry of the shell. A cylindrical shell analysis is presented as an illustrative numerical example.
Author (TAB)

N71-12024*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Engineering Mechanics Div.
HIGH-IMPACT DYNAMIC RESPONSE ANALYSIS OF NONLINEAR STRUCTURES
K. K. Gupta 15 Nov. 1970 55 p refs Sponsored in part by Natl. Res. Council
(Contract NAS7-100)
(NASA-CR-111404; JPL-TR-32-1496) Avail: NTIS CSCL 20K

An efficient and generalized digital computer method is presented for determining the dynamic response of nonlinear structures of simple geometric configuration subjected to high impact loading. A finite element matrix displacement approach utilizing quadrilateral shell elements, in conjunction with a step by step integration procedure employing Runge – Kutta extrapolation techniques was adopted for the present analysis. The related procedure yields reliable results for simple structural forms, rectangular and cylindrical panels, and requires only moderate computer storage and solution time. Numerical results are presented for the analysis of relevant structures subjected to high impact, simulating free landing on a planetary surface. Author

N71-12029# Asian Inst. of Tech., Bangkok (Thailand).

BENDING OF CIRCULAR PLATES SUPPORTED ON EQUALLY SPACED COLUMNS UNDER AN ECCENTRIC CONCENTRATED LOAD

Kasem Chantaramungkorn (M.S. Thesis) 1970 31 p refs
(Rept-286) Avail: NTIS

A solution for the bending of a full circular plate supported on equally spaced columns and subjected to an eccentric concentrated load is presented. The complete solutions for circular plates supported on three and four equally spaced columns are shown. The problem is solved under the assumptions that the columns do not restrain the rotation of the slab, and that the column reaction is uniformly distributed along the column width. The limiting case where the load is applied at the center of the plate is investigated and parametric studies are carried out. Numerical results are given for the case with arbitrary number of columns and subjected to a central load and the case with three columns under an eccentric concentrated load are presented in the form of charts to facilitate the analysis and design of such structures. Author

N71-12030# Asian Inst. of Tech., Bangkok (Thailand).

UNIFORMLY LOADED ORTHOTROPIC RECTANGULAR PLATE SUPPORTED AT THE CORNERS

Mohammed Zakeria (M.S. Thesis) 1970 39 p refs
(Rept-290) Avail: NTIS

An approximate solution for a uniformly loaded orthotropic rectangular plate supported at the corners is proposed in the form of polynomials. Applications of the results to reinforced concrete slabs and plates with stiffeners are also discussed. Author

N71-12044# European Space Tracking Center, Fairbanks, Alaska.

PILE FOUNDATIONS IN THERMALLY FRAGILE FROZEN SOILS

J. M. Miller Jan. 1970 26 p refs
(ESRO-TN-85-ESTRACK) Avail: NTIS

Some special techniques for building in subarctic areas are described. These include a standard steel pile with a floating sleeve and a pressurized steel pile which forms a self-acting refrigeration system using seasonal temperature variations as the sole energy input. Results show that the more costly refrigerated piles prove their worth where critical stability is required. Author (ESRO)

N71-12050*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECTS OF SURFACE AND THROUGH CRACKS ON FAILURE OF PRESSURIZED THIN-WALLED CYLINDERS OF 2014 T6 ALUMINUM

William S. Pierce Washington Nov. 1970 19 p refs
(NASA-TN-D-6099; E-5746) Avail: NTIS CSCL 20K

Cylinders with a 0.060-in. (0.152-cm) wall thickness and a mean diameter of 5.6 inches (14.3 cm) were tested at −320 F (77 K). Crack lengths were varied from 0.10 to 1.0 in. (0.25 to 2.5 cm). Surface-crack depths ranged from 36 to 98 percent of wall thickness. In only one test was the leak-before-break phenomenon observed. For all other tests, the failure stress for the surface crack was higher than for a through-the-thickness crack of equal length. The failure stresses for cylinders containing short cracks were less affected by crack depth than for those with long cracks. The Irwin surface-crack analysis was used to determine an apparent fracture toughness, which was found to be essentially constant. Author

N71-12051# Notre Dame Univ., Ind. Coll. of Engineering.

ELASTIC STABILITY OF CYLINDRICAL SHELLS UNDER EXTERNAL PRESSURE

Cary K. K. Mak, Luis E. Amaya, and Harry C. Saxe Jun. 1970 31 p refs
(Contract N00014-68-A-0152; Proj. Themis)
(AD-712111; THEMIS-UND-70-3) Avail: NTIS CSCL 20/11

Numerical determination of the nonlinear, large displacement behavior of a complete circular cylindrical thin shell subjected to a uniform radial pressure is presented. By including second order nonlinear terms, the total potential energy of the shell system is minimized by a variation-difference method from which the load-deformation relation of the shell is obtained. The results are compared with existing linear solutions. Author (TAB)

N71-12052# Technical Univ. of Norway, Trondheim. Dept. of Ship Structures.

A FINITE ELEMENT STUDY OF ELASTIC-PLASTIC STRESS DISTRIBUTIONS IN NOTCHED SPECIMENS UNDER TENSION

Jacek Kapkowski 1968 52 p refs Sponsored by the Roy. Norweg. Council for Sci. and Ind. Res.
(SKB-2/M-13) Avail: NTIS

A description of an incremental elastic-plastic analysis of plane stresses in specimens with notches or holes under tension is given. The calculations were made with uniformly distributed loads at the ends of the specimens. Four series of specimens were studied. The finite element method of stress analysis with uniformly stressed triangular elements was used, assuming the Huber von Mises law of plastic yielding. The results of calculations obtained by means of a Univac 1107 computer, are presented in diagrams showing the extension of the elastic-plastic boundary, and the tensile stress distribution across the minimum cross-section. Diagrams of first plastic straining loads, maximum load carrying capacities, and stress concentration factors are also shown. Calculations were also performed using the yield criterion of Tresca-Coulomb and the results were compared with experimental data. Author (ESRO)

N71-12065# Sandia Corp., Livermore, Calif. Analytical Mechanics Div.

ANALYSIS OF ORTHOTROPIC LAYERED PLATES SUBJECTED TO GENERAL EDGE LOADS AND TEMPERATURE DISTRIBUTIONS

Oemer A. Fettahlioglu 1970 86 p refs
(SCL-DR-69-115) Avail: NTIS

The analysis is concerned with the behavior and the strength characteristics of fiber-reinforced, laminated orthotropic plates subjected to both in-plane axial and shear loads, and to bending and twisting moments as well as thermal loads. Based on the results of the computer programmed analysis presented, composite plates may be designed with optimum use of the inherent strength characteristics of the constituent materials. A complete listing of the computer program in Fortran 4 is presented, including a list of input data. A sample problem is given to facilitate the use and the checkout when the program is compiled on other computer systems, and to demonstrate input and output. Author

N71-12081# Indian Inst. of Science, Bangalore. Dept. of Aeronautical Engineering.

BUCKLING OF ORTHOTROPIC SKEW PLATES

M. S. S. Prabhu and S. Durvasula Feb. 1970 19 p refs
(AE-266-5) Avail: NTIS

The buckling problems of orthotropic skew plates involving simple support and clamping are considered. The in-plane stresses are represented in terms of oblique components. The Rayleigh-Ritz method is used, employing a double series of functions appropriate to the combination of the edge conditions. Numerical results are presented for a clamped orthotropic skew plate under direct and shear loadings for a typical orthotropic material. Author

N71-12085# Construction Engineering Research Lab. (Army), Champaign, Ill.

FEASIBILITY STUDY OF PHOTOMECHANICS TECHNIQUES APPLIED TO STRESS ANALYSIS IN THREE DIMENSIONS
Final Report

John H. Hubbard Oct. 1969 77 p refs
(AD-711526; CERL-TR-4-84) Avail: NTIS CSCL 20/11

The report presents the results of a study into the experimental techniques of full field representation applicable to stress analysis in three dimensions. The simple case of the distribution of stress on the boundary of a circular discontinuity in an elastic half space was examined from the viewpoint of existing theory and verified by model analysis employing eight experimental approaches. Two models were two dimensional in nature and provided an experimental standard for the other models as well as a demonstration of the flexibility of experimental stress analysis. The most accurate representation of stress distribution for the three dimensional models were the Frozen Stress and Scatterred Light models. Less accurate representations were obtained with the Composite, Embedded Polariscope and Embedded Moire Models. Finally, the feasibility was investigated of applying the techniques of Holography to photoelastic model. Each of these approaches is discussed in detail, and the advantages and disadvantages of each critically examined. Author (TAB)

N71-12094# Asian Inst. of Tech., Bangkok (Thailand).

ANNULAR SLAB SUPPORTED ON COLUMNS ALONG INNER BOUNDARY AND FIXED AT OUTER BOUNDARY

Komen Charoensukvanich (M.S. Thesis) 1970 28 p refs
(Rept-293) Avail: NTIS

An annular slab fixed at the outer edge and supported by equally spaced columns on the inner edge is analyzed. The thin plate theory is used. The results are presented in tables and charts which show that deflection and stress resultants decrease as the radio of the inner radius to the outer radius increases. The number of columns, with the range of four to sixteen, has little effect on the maximum radial bending moment, but the maximum magnitudes of the other stress resultants and deflection decreases as the column number increases. Reducing the column width increases the shearing forces and the transverse bending moment. The deflection and the radial bending moment are insensitive to the variation of the column width. Author

N71-12098# Virginia Polytechnic Inst., Blacksburg. Dept. of Engineering Mechanics.

PHOTOELASTIC DETERMINATION OF MIXED MODE STRESS INTENSITY FACTORS

Dallas G. Smith and C. W. Smith Jun. 1970 31 p refs
Presented at the 4th Natl. Symp. on Fracture Mech., Pittsburgh, 24-26 Aug. 1970
(Contract DAAF07-69-C-0444; Proj. Themis)
(AD-712298; VPI-E-70-16) Avail: NTIS CSCL 20/11

Using an idea proposed by G. R. Irwin, equations were developed for the maximum in-plane local shearing stress Tau sub m and average fringe loop inclination Theta sub m near the crack tip in terms of the Mode 1 and Mode 2 stress intensity factors K1 and K2 and polar coordinates r and Theta measured from the crack tip. A series of photoelastic experiments was performed on specimens exhibiting various edge crack configurations in finite strips under remote tensile loading. Measurements of Tau sub m and Theta sub m were made for progressively smaller fringes and used in the above mentioned equations to solve for K1 and K2 on a digital computer. Plots of apparent K versus r/a were made and extrapolated to the crack tip to yield the true values of K1 and K2. Results compared favorably with numerical results of Wilson. New results for angle cracks were also obtained. Author (TAB)

N71-12099# Notre Dame Univ., Ind. Coll. of Engineering.

STRESS CONCENTRATION AROUND A HOLE IN BENT PLATES

Cary K. Mak, D. W. Kao, and Sydney Kelsey Jan. 1970 94 p refs
(Contract N00014-58-A-0152; Proj. Themis)
(AD-712109; THEMIS-UND-70-2) Avail: NTIS CSCL 20/11

The finite element procedure is applied to determine the stress concentration in the region of a hole in plates subjected to transverse loading. The finite element adopted in the analysis is that of an arbitrary triangular hybrid element. To accurately depict the sharp stress gradient in the stress concentration region, a step-by-step numerical scheme is incorporated in the finite element analysis in which the overall stress concentration region is reduced proportionally as the element sizes are successively reduced. Thus, during the entire solution process, the total number of simultaneous equations to be solved is kept to a reasonable number even though the element size approaches an infinitesimal limit much smaller than the plate thickness. Author (TAB)

N71-12100# Virginia Polytechnic Inst., Blacksburg. Dept. of Engineering Mechanics.

THE DYNAMIC ORTHOTROPIC DUGDALE MODEL

Henry Gonzalez, Jr. and Halbert F. Brinson Aug. 1970 42 p refs
(AD-712122; VPI-E-70-12) Avail: NTIS CSCL 20/11

The problem of ductile fracture in anisotropic solids is an important engineering problem. In this report the Dugdale model is assumed, that is, the yielded zone is replaced by a constant yield stress. A solution is presented for an orthotropic dynamic solid. The solution was obtained by the complex variable approach. Stress functions which must satisfy a generalized bi-harmonic equation are represented in terms of two analytic functions of two different complex variables. In this way boundary value problems can be reduced to problems of complex function theory. The yield stress is assumed to follow a Von Mises yield criterion which was adapted to the orthotropic dynamic case. It was found that the plastic zone is given by the same relation as in the isotropic-static case. Any orthotropic dynamic parameter may be obtained from the corresponding isotropic dynamic parameter by simply multiplying the orthotropic parameter by a coefficient. A limit on yielding along the line of the crack and therefore a limit on the anisotropy and velocity are derived. Author (TAB)

N71-12102# Army Engineer Waterways Experiment Station, Vicksburg, Miss.

FOUNDATION INVESTIGATIONS, NASA MISSISSIPPI TEST FACILITY. REPORT 1: STATIC AND VICRATORY LOAD TESTING OF FOUNDATION PILES AT TEST STAND S-1C

John B. Stevens Nov. 1969 91 p refs Sponsored by NASA
(NASA-CR-111363; AD-698028; AEWES-TR-S-69-10-1) Avail: NTIS CSCL 13M

Investigations were conducted to determine the behavior of steel H piles and concrete-filled pipe piles subjected to static and vibratory loads. Field tests included static and vibratory loading of single piles and vibratory testing of a group of four H piles with a common cap. Each single pile and one pile of the four-pile group were instrumented with bonded foil-type gages prior to driving. Static loads of up to 200 tons were applied incrementally, and vibratory loads from 1 to 10 tons were applied over a range of frequencies at various static loadings. Strain, settlement, dynamic displacement, and critical frequencies were determined. Fundamental theory was developed for the dynamic behavior of the soil-pile system, and the theoretical data were compared with the experimental data. This study showed that the dynamic behavior of piles subjected to vibratory loads can be determined from static load tests and dynamic theory. Author (TAB)

N71-12105# Air Force Systems Command, Wright-Patterson AFB, Ohio. Materials Lab.

SHEAR DEFORMATION IN HETEROGENEOUS ANISOTROPIC PLATES Technical Report, Jun. – Dec. 1969

J. M. Whitney and N. S. Pagano Jul. 1970 31 p refs
(AD-711920; AFML-TR-70-31) Avail: NTIS CSCL 20/11

A bending theory for anisotropic laminated plates developed by Yang, Norris, and Stavsky is investigated. The theory includes shear deformation and rotary inertia in the same manner as Mindlins theory for isotropic homogeneous plates. The governing equations reveal that unsymmetrically laminated plates display the same bending-extensional coupling phenomenon found in classical laminated plate theory based on the Kirchhoff assumptions. Solutions are presented for bending under transverse load and for flexural vibration frequencies of symmetrical and nonsymmetrical laminates. Good agreement is observed in numerical results for plate bending as compared to exact solutions obtained from classical elasticity theory. For certain fiber reinforced composite materials, radical departure from classical laminated plate theory is indicated. Author (TAB)

N71-12144# Rome Univ. (Italy). School of Aerospace Engineering.

THE INFLUENCE OF THERMAL AND ELASTIC VARIATIONS ON THE DISTRIBUTION OF THERMAL STRESSES [INFLUENZA DELLE VARIAZIONI DEI PARAMETRI ELASTICI E TERMICI SULLA DISTRIBUZIONE DEGLI SFORZI TERMICI]

Paolo Santini Dec. 1969 44 p refs In ITALIAN
(Contract CNR-115/0481.0/3900)
Avail: NTIS

The influence that variations of thermal conductivity with temperature has on the thermal distribution in an isotropic-elastic body are examined. How the distribution of the stresses are influenced by the elastic constants and the coefficient of thermal expansion with variations of temperature are also studied. A graphic treatment of general cases of flat plates and curved shells is presented. Transl. by F.O.S.

N71-12148# Southwest Research Inst., San Antonio, Tex.

A TECHNIQUE FOR RANDOM VIBRATION EQUALIZATION USING VERSATILE LABORATORY APPARATUS Final Report

Daniel D. Kana and Dennis C. Scheidt 15 Nov. 1970 26 p refs
Avail: NTIS

A technique is presented for equalization or shaping of random vibration excitation spectra by the use of two analog tape recorders along with standard signal analysis equipment. The final result simulates the effects of a straightforward 196-channel manual equalizer system. However, accuracy, resolution, and total number of channels can all be varied beyond the limits available in current commercial equalizers. At the same time, equalization is performed with more versatile equipment, such as is more likely to be justifiable in a small laboratory. The principal disadvantage of the method is excessive set-up time, the same as for any manual equalization system. Suggestions for overcoming this disadvantage are given. Author

N71-12174# Utah Univ., Salt Lake City. Coll. of Engineering.

THERMODYNAMICS OF MATERIALS WITH MEMORY

William L. Hufferd (Ph.D. Thesis) May 1970 214 p refs
(Contract F-44620-68-C-0022; Proj. Themis)
(AD-711401; THEMIS-UTEC-TH-70-076; AFOSR-70-1961TR)
Avail: NTIS CSCL 20/11

A continuum thermodynamic theory of nonlinear thermomechanical materials with memory is developed and its application to the observed behavior of real materials discussed. Following a review and summary of the basic concepts of modern continuum mechanics an in-depth discussion and appraisal of the axiomatic foundations of thermomechanical constitutive theory is presented. An extended principle of equipresence is proposed which appears to be necessary for the rigorous axiomatic development of thermomechanical constitutive theories. A new physical principle of fading memory is next introduced which extends previous principles of fading memory to include finite memory and permanent memory. Coupling between memory effects under different loading situations is allowed. Colemans continuum thermodynamic theory is also extended to admit materials and processes capable of instantaneous dissipation. With these extensions, the constitutive theory developed herein admits classes of materials and processes which are more closely related to the observed physical behavior of real materials under a variety of loading environments. In particular, the constitutive theory is directly applicable to viscoelastic solids, inelastic deformations such as plasticity and viscoplasticity, and reduces to previous special theories of idealized materials under appropriate simplifying assumptions. Author (TAB)

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N71-11127*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

ANALYSIS OF CHARRING ABLATION WITH DESCRIPTION OF ASSOCIATED COMPUTING PROGRAM

Fred W. Matting Washington Nov. 1970 87 p refs
(NASA-TN-D-6085; A-3614) Avail: NTIS CSCL 11B

A general method is presented for solving the problem of heat-shield response in the stagnation region of a charring type ablator. The analysis is actually for the stagnation point of an axisymmetric blunt body, but it is a valid approximate method for calculations in the stagnation region of any arbitrary blunt body. The analysis is applicable to wind tunnel or flight conditions, and the heat loadings are either arbitrarily assigned or they are calculated concurrently with the heat-shield response. Surface heating (or cooling) mechanisms accounted for are those due to convection, radiation, homogeneous combustion, heterogeneous combustion, surface material removal by means other than combustion (includes erosion), and sublimation. Physical and thermodynamic properties of the ablating material are arbitrarily assigned so that calculations can be made for various materials. A typical application of the analysis is given as an illustration. The analysis is machine programmed for numerical solutions using a finite difference scheme, and a family of computing programs is used. These programs are described and instructions are provided for using them. Author

N71-11134# Virginia Univ., Charlottesville.

SCINTILLATION EFFECTS IN SUPERFLUID HELIUM Final Report, 3 Dec. 1963 – 2 Jun. 1970 AND 23 Jan. – 11 Jul. 1969

Frank L. Hereford and Robert C. Taylor 24 Aug. 1970 9 p refs
(Grants DA-ARO(D)-31-124-G516; DA-ARO(D)-31-124-G744; DA-ARO(D)-31-124-G876; DA-ARO(D)-31-124-G1066)
(AD-711583; AROD-4685-8-P) Avail: NTIS CSCL 20/13

The program of research with which this report is concerned is an outgrowth of the discovery several years ago that the scintillation of He 2, produced by charged particles, is influenced markedly by the superfluid properties of the liquid. During the ensuing period the program has involved continued experimental studies of the anomalous He 2 scintillation process, the achievement of an understanding of the effect, and study of some unexpected phenomena which have been discovered relating to heat transport in He 2. Author (TAB)

N71-11135# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

HEAT FLUX MEASUREMENTS ON FIXED TURBINE BLADES [MESURES DE FLUX DE CHALEUR SUR AUBES FIXES DE TURBINES]

–Jacques Michard 1970 10 p refs In FRENCH; ENGLISH summary Presented at the AGARD Meeting on High Temp. Turbines, Florence, 21 –25 Sep. 1970 Submitted for publication
(ONERA-TP-871) Avail: NTIS

Experimental results obtained on a setup including a moderately high temperature combustion chamber (1300 K) and two stages of fixed blades are presented. The first stage is used as a distributor, the other one is turning the flow parallel to its upstream direction at the outlet. Heat transfer and local exchange coefficients obtained with an upstream Mach number of 0.2 and a Reynolds number of 2.5 x 10,000 per cm are analyzed. Author (ESRO)

N71-11136# Royal Aircraft Establishment, Farnborough (England).

THERMAL CONTROL SURFACE RESEARCH AT THE ROYAL AIRCRAFT ESTABLISHMENT

A. E. Smith Nov. 1968 37 p refs
(RAE-TR-68276) Copyright. Avail: NTIS

The report defines four basic classes of thermal control surface and the research being carried out on each type of surface. Details are given on the apparatus used to measure the reflectance properties of the surfaces and the facilities available to simulate the space environment The preliminary design of a satellite-borne experiment to test thermal control surfaces in space is also described. Author

N71-11405*# TRW Systems, Redondo Beach, Calif.

DEVELOPMENT OF DIGITAL COMPUTER PROGRAM FOR THERMAL NETWORK CORRECTION. PHASE 2: PROGRAM DEVELOPMENT. PHASE 3: DEMONSTRATION/APPLICATION Final Report

T. Ishimoto, J. D. Gaski, and L. C. Fink Sep. 1970 144 p refs
(Contract NAS9-8289)
(NASA-CR-108681; TRW-11027-6002-R0-00) Avail: NTIS CSCL 20M

The development of a computer program that corrects soft parameters of a thermal network, such that the temperatures from the updated thermal network correlates with the measured temperature data is discussed. Evaluation of the thermal network correction program with the use of two 50-node models and one 500-node model revealed promising results in many respects on the one hand but also indicated some limitations on the other. When complete temperature measurements are available in a region or a subregion, the Kalman filtering method of processing the set of equations sequentially and each equation timewise in a sequential sense yielded accurate correction of those parameters that were both observable and subject to significantly changing nodal temperatures. Parameters that were not observable and/or insensitive to nodal temperatures were corrected; parameters that were subject to temperatures that did not change significantly were corrected very little. Author

N71-11719*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

ZERO GRAVITY FLAMMABILITY

John Howard Kimzey *In its* Space Process. and Manufacturing 21 Oct. 1969 p 323–335 refs (See N71-11701 02-15)
Avail: NTIS CSCL 21B

A study of flammability in a zero-g environment, based on results obtained during aircraft flight, is discussed. The need for long-duration zero-g testing to study inflight spacecraft fire propagation, safe spacecraft designs, and methods of fire extinguishment is shown. The objectives of Apollo Applications Program Experiment M-479 (which concerns flammability in zero g and the equipment needed for the experiment) are discussed. Author

N71-11723*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

HEAT SOURCES FOR SPACE MANUFACTURING PROCESSES

John R. Rasquin *In its* Space Process. and Manufacturing 21 Oct. 1969 p 375–382 (See N71-11701 02-15)
Avail: NTIS CSCL 13A

Examined are the various possible heat sources for manufacturing processes requiring heat in the environment of space and zero-G. A rough analysis of the usefulness of the heat sources with respect to weight, bulk, power requirements, reliability, safety of operation, and cost where applicable to any of the various manufacturing process experiments proposed for the AAP program is made. It is assumed that a primary source of electric power is available, large enough to meet the demand in each instance. Author

N71-12057*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

A SYSTEMATIC REVIEW OF HEAT-SHIELD TECHNOLOGY FOR EXTRATERRESTRIAL ATMOSPHERIC ENTRY

Robert G. Nagler 15 Mar. 1970 90 p
(Contract NAS7-100)
(NASA-CR-111377; JPL-TR-32-1436) Avail: NTIS CSCL 13A

Heat shield technology is reviewed systematically by considering individually each parameter that contributes to heat shield design. These parameters range from ablation models to pyrometer calibration, from the effects of adding fluorine to polymeric molecules to nondestructive testing of finished heat shield subsystems. Each parameter is rated as to its effect upon mission success and heat shield design, and tasks are formulated to investigate the most important parameters analytically or experimentally. As an example ot the utility of the review methodology, alternative research and development support activities are delineated for typical Venus entry missions based upon the formulated tasks and their criticality ratings. Author

N71-12058# Rocket Propulsion Establishment, Westcott (England).

CONVECTIVE HEAT TRANSFER IN ROCKET ENGINES. PART 5: NON-UNIFORM BOUNDARY LAYER EFFECTS

R. C. Parkinson May 1970 44 p refs
(RPE-TR-70/3) Avail: NTIS

The effects of chemical nonequilibrium in the boundary layer, of temperature variation and compressibility assumptions, and of systematic errors in the estimated transport properties upon the heat transfer in rocket engines have been investigated. Hydrogen recombination and hydrogen/hydroxyl recombination appear to be the important reactions in determining the degree of chemical equilibrium occurring within the boundary layer. The important effect of chemical reaction upon the heat transfer is to increase the available enthalpy drop across the boundary layer. There appear to be systematic errors in the current methods of calculating the transport properties of combustion gas mixtures containing hydrogen as a component. Author (ESRO)

N71-12059# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

CALORIMETRIC HEAT FLUX MEASUREMENTS IN

WIND-TUNNELS [METHODE CALORIMETRIQUE DE MESURE DES FLUX DE CHALEUR EN SOUFFLERIE]

Jean-Pierre Chevallier, Jean Ponteziere, and Andre Betremieux 1970 27 p refs In FRENCH; ENGLISH summary
(ONERA-NT-159) Avail: NTIS

The study of kinetic heating of bodies with complicated shapes entails more and more accurate measurements. The testing methods have to be adapted to the specific heating conditions of the models and to the facility used. With the method developed for blowdown wind tunnels it is possible to measure even very weak convection fluxes with a remarkable accuracy, thanks to a refinement of the technique for inserting the thermocouples within the model skin, and to a critical study of the calorimeter design and conditions of use. The technological details and the theoretical study described must be considered as a whole in the use of the process and for ascertaining the accuracy of the results. This method might easily be extended to very different measuring conditions, such as those met in flight tests. Author (ESRO)

N71-12066*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CARBON MONOXIDE OXIDATION RATES COMPUTED FOR AUTOMOBILE EXHAUST MANIFOLD REACTOR CONDITIONS

Richard S. Brokaw and David A. Bittker Washington Dec. 1970 21 p refs
(NASA-TN-D-7024;E-6035) Avail: NTIS CSCL 21B

Carbon monoxide oxidation rates were computed by integrating differential equations for a system of 29 reversible chemical reactions. At temperatures above about 1030K oxidation is rapid and is complete in times short in comparison to the residence times in exhaust manifold reactors. This suggests that such reactors. This suggests that such reactors are mixing rate limited, not reaction rate limited. At temperature the reaction is catalyzed by nitric oxide. Thus, elimination of nitric oxide from automotive exhausts might degrade the low temperature performance of exhaust manifold reactors. Author

N71-12067*# North American Rockwell, Downey, Calif. Productior Engineering and Development Dept.

LOW COST ABLATIVE HEAT SHIELD FOR SPACE SHUTTLES Final Report, Apr. - Nov. 1970

20 Nov. 1970 166 p
(Contract NAS1-9943)
(NASA-CR-111795; SD-70-400) Avail: NTIS CSCL 13A

Four ablative material compositions were used to fabricate four flat and four curved 2-foot by 4-foot by 2-inch-thick panels. The panels consisted of a honeycomb matrix bonded to a face sheet and filled with ablation material. Production methods were developed for fabricating the panels, and cost data were compiled. Among the unique fabrication processes used were vacuum bagging the panel to the final required thickness (thus eliminating surface machining) and making curved panels by filling the honeycomb matrix with ablator in the flat and curing to the curved shape. Cost estimates are included for production lots of 1, 10, and 100 panels in various sizes and shapes. Author

N71-12075# Army Foreign Science and Technology Center, Washington, D. C.

EFFECT OF ELECTRIC AND MAGNETIC CROSS FIELDS ON THE AERODYNAMICS AND THERMAL REGIME OF A GAS FLAME CONE

L. P. Yarin 16 Jun. 1970 14 p refs Transl. into ENGLISH from Teoriya i Prakt. Szhiganiya Gaza, Tr. Nauchn. Tekhn. Soveshch. (Moscow), v. 13, 1967 p 128-135
(AD-712336; FSTC-HT-23-086-70) Avail: NTIS CSCL 20/13

In the boundary layer there is a narrow, high temperature zone (a region of active reaction of the original components) within which the gas is a conductor. Outside this region the conductivity of fuel, oxidizer, and the products of combustion in the entire flux field is believed equal to zero. In this connection, the calculations for the field of flux outside the effective zone can be made by the usual gas dynamic methods, and the unknown values of temperature and velocity at the borders of the zone defined are found from the supplementary conditions, taking into account the electrical and magnetic influence. The balance of forces and heat equations are used as supplemental conditions. Author (TAB)

N71-12084# Army Cold Regions Research and Engineering Lab., Hanover, N. H.

THE HEAT AND MASS TRANSFER DURING VAPOR CONDENSATION IN THE PRESENCE OF NONCONDENSING GASES

L. D. Berman 1970 22 p refs Transl. into ENGLISH From Izv. Yses. Teplotekhn. Inst. (USSR), v. 16, no. 8, Aug. 1947 p 11-18
(AD-712246) Avail: NTIS CSCL 20/13

The article gives a brief review of the investigations carried out, it shows the permissible areas of application of the relationships suggested by different authors for the heat- and mass-transfer coefficients and notes the errors contained in some of the works. TAB

N71-12103*# Bureau of Mines, Pittsburgh, Pa. Safety Research Cnter.

HYDROGEN FLARE STACK DIFFUSION FLAMES: LOW AND HIGH FLOW INSTABILITIES, BURNING RATES, DILUTION LIMITS, TEMPERATURES, AND WIND EFFECTS

J. Grumer, A. Strasser, J. M. Singer, Patricia M. Gussey, and Valeria R. Rowe Dec. 1970 38 p refs Sponsored in part by NASA and AEC
(NASA-CR-111419; BM-RI-7457) Avail: NTIS CSCL 21B

A laboratory-scale hydrogen safety study was conducted which determined several combustion characteristics of hydrogen diffusion flames. Experiments show that ambient air may enter the top of a hydrogen flare stack when the hydrogen flow is low. A new concept, supported by photographic evidence, predicts that diffusion flames burning in air on a wide, upright pipe (stack) and fed with slow, upward flows of buoyant gas will induce a downward flow of air along the walls of the pipe that can support combustion within the pipe. Predicted flamedip limits agree roughly with experimental values determined on 6-, 12-, and 18-inch diameter stacks and increase with increasing stack diameter. Measurements were made of the limiting flow at which a hydrogen diffusion flame blows out in still air. By means of an empirical application of the critical boundary velocity gradient concept, these data lead to a blowout limit of about 10 to the 8th power reciprocal seconds for a hydrogen diffusion flame. Burning rates of large hydrogen diffusion flames ranging from about 0.03 to 1 ft/sec were used to predict approximate flame heights on flare stacks. Author

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N71-11125*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

RESEARCH ACHIEVEMENTS REVIEW. VOLUME 3: COMPUTATION RESEARCH AT MSFC

1970 35 p
(NASA-TM-X-64527; Rept-12-Vol-3) Avail: NTIS CSCL 05A

This review, the third volume in the series, sets forth research achievements during this period utilizing SI Units. The following papers are presented: Optical Probe for Visual Simulation; Computer Generated View of a Lunar Landscape; Hybrid Simulation of Vehicle Response to Many Measured Winds; Telemetry Language System; Experimental Results Concerning the Error Propagation in Runge-Kutta Type Formulas; and Marshall Vehicle Engineering Simulation System. E.M.C.

N71-11131# Centre National d'Etudes Spatiales, Paris (France).
THE NATIONAL CENTER OF SPACE STUDIES: ITS ACTIVITIES [LE CENTRE NATIONAL D'ETUDES SPATIALES: SES ACTIVITES]
M. Bignier 1970 5 p In FRENCH Presented at the Space Symp., Rennes, France, 16–19 Jun. 1970; sponsored jointly by CNES, Centre de Perfectionnement Tech., and Fac. des Sci. de Rennes
Avail: NTIS

The initial phase of development of the Centre National d'Etudes Spatiales (CNES) and its constitution are reviewed. Its present organization and its subordination to different ministerial departments are explained. Facilities and purposes of each center are analyzed together with programs. A review is made of what has been achieved, what is being achieved and what achievements are expected for the period covered by the sixth development plan. ESRO

N71-11150# American Inst. of Physics, New York. Information Div.
A PROGRAM FOR A NATIONAL INFORMATION SYSTEM FOR PHYSICS AND ASTRONOMY 1971–1975
Jun. 1970 127 p refs
(Grants NSF GN-601; NSF GN-710; NSF GN-713 NSF GN-863; NSF GN-864; NSF GN-865)
(PB-192717; AIP-ID-70-P) Avail: NTIS CSCL 05B

Contents: System goals, priorities, and strategy; Scientists and information channels in physics and astronomy; Achievement of a secondary capability–pilot operations of stage 1; Future development of the system. USGRDR

N71-11382 Royal Naval Scientific Service, London (England).
LIBRARY BULLETIN NO. 8
1970 69 p refs
Copyright. Avail: Issuing Activity

A bibliography of behavioral, social, biological, physical and medical science is presented. Also included are nuclear science, communication systems, mechanical, industrial, civil, and marine engineering. Abstracts of selected topics are included. E.H.W

N71-11443*# Denver Univ., Colo. Dept. of Mechanical Sciences and Environmental Engineering.
PROGRAM FOR THE EXPLOITATION OF UNUSED NASA PATENTS Annual Report, 1 Jun. 1969 – 31 May 1970
31 May 1970 192 p refs
(Grant NGL-06-004-078)
(NASA-CR-111374; AR-2) Avail: NTIS CSCL 05A

A program to exploit unused NASA patents through the use of a multidisciplinary approach involving faculty, students, and research staff is discussed. NASA patents are screened for their applicability outside the space program, specific applications are identified, and the technical and commercial feasibility of these applications is established. The program is specifically interested in energy absorbing devices such as those developed for lunar soft landings. These energy absorbing devices absorb large amounts of mechanical energy but are, in general, not reusable. Some of these devices can also operate as structural elements until their structural load capacity is exceeded and they become activated as energy absorbers. The capability of these devices to operate as structural elements and as energy absorbing devices makes them candidates for many applications in the fields of transportation and materials handling safety where accidents take a large toll in human injury and property damage. Author

N71-11892# RAND Corp., Santa Monica, Calif.
PROGRAM BUDGETING: ITS UNDERLYING SYSTEMS CONCEPTS AND INTERNATIONAL DISSEMINATION
David Novick and Daniel J. Alesch Sep. 1970 28 p refs
Submitted for publication
(AD-711903; P-4462) Avail: NTIS CSCL 5/1

In the document, program budgeting has been viewed as an aid to government in its role of guiding and managing social, economic and environmental systems within governments jurisdiction. The origins of the planning-programming-budgeting system have been traced and its development in the United States and world-wide has been described. Concepts from general systems theory and from cybernetics are rooted in the approaches which characterize program budgeting. Implementation in numerous countries throughout the world illustrates the flexibility of the system. Author (TAB)

N71-11893# George Washington Univ., Washington, D.C. Program of Policy Studies in Science and Technology.
THE RELATIONSHIP OF TECHNOLOGY ASSESSMENT TO ENVIRONMENTAL MANAGEMENT
Louis H. Mayo Oct. 1969 38 p refs *Its* Staff Discussion Paper No. 206
(PB-192554) Avail: NTIS CSCL 05A

Contents: Growing concern over technological development; The existing technology assessment function; Diverse attitudes toward technology assessment; Total impact assessments; The Congressional focus on technology assessment. USGRDR

N71-12040# Stanford Univ., Calif. Electronics Labs.
[PLASMA PHYSICS, QUANTUM AND SOLID STATE ELECTRONICS, INFORMATION SYSTEMS, AND DIGITAL SYSTEMS] Quarterly Status Report, No. 118, 1 Apr. – 30 Jun. 1970
30 Jun. 1970 93 p refs Sponsored in part by AF and Army
(Contract N00014-67-A-0112-0044)
(AD-711816; SU-SEL-70-031; QSR-118) Avail: NTIS CSCL 9/5

Contents: Plasma physics and quantum electronics; Radioscience; Solid-state electronics; Information systems; and Digital systems. TAB

N71-12068# Centre National d'Etudes Spatiales, Paris (France).
PROJECT MANAGEMENT [LA GESTION D'UN PROJET]
I. Chvidchenko 1970 22 p In FRENCH Presented at the Space Symp., Rennes, France, 16–19 Jun. 1970; sponsored jointly by CNES, Centre de Perfectionnement Tech., and Fac. des Sci. de Rennes
Avail: NTIS

Project management problems and solutions to them at different levels, such as client, project manager and subcontractors are described and the importance of global management is stressed. Managerial organization, document flow, delegation of responsibility, and relations with contractors are analyzed and delays and cost control are discussed. ESRO

N71-12069# Centre National d'Etudes Spatiales, Paris (France). Div. 'Politique Industrielle.'
INDUSTRIAL POLICY AT THE CENTRE NATIONAL D'ETUDES SPATIALES [LA POLITIQUE INDUSTRIELLE DU CENTRE NATIONAL D'ETUDES SPATIALES]
A. Simon 1970 12 p In FRENCH Presented at the Space Symp., Rennes, France, 16–19 Jun. 1970; sponsored jointly by CNES, Centre de Perfectionnement Tech., and Fac. des Sci. de Rennes
Avail: NTIS

The Centre National d'Etudes Spatiale (CNES) has adopted the policy of allowing the French aerospace industry to participate in its space program. This paper discusses this policy, the conditions and operations both in the past and in the future. ESRO

N71-12101# Compagnie Francaise Thomson Houston-Hotchkiss Brandt, Paris.

INNOVATION [L'INNOVATION]

L. Gerardin, ed. Apr. 1970 34 p In FRENCH Proc. of a Symp. on Innovation, Paris, 9–10 Mar. 1970
(LG/MT-LCR/DR2-580/70) Avail: NTIS

The principal characteristics of the process of innovation are reviewed and in particular its development in time and space. Examples are given and the reasons for resistance to innovation are analyzed. Methods of how to introduce innovation are also presented. ESRO

N71-12106*# National Aeronautics and Space Administration, Washington, D.C.

SPEECH BY GEORGE M. LOW, ACTING ADMINISTRATOR, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, AT THE EIGHTH ANNUAL BRIEFING ON NEW HORIZONS IN SCIENCE: NEWS RELEASE

George M. Low 19 Nov. 1970 13 p Council for the Advan. of Sci. Writing Briefing held in Raleigh, N.C., 19 Nov. 1970
Avail: NASA Scientific and Technical Information Division CSCL 05B

The applications of and the relevance of NASA space programs are discussed. Applications are given for present day use and for future use as well. Particular attention is given to observations of terrestrial phenomena and communication relay systems. E.H.W.

N71-12119# Civil Aeronautics Board, Washington, D.C.

STUDY GROUP ON LEGAL ASPECTS OF INTERMODAL TRANSPORTATION

Whitney Gillilland 1970 8 p refs Conf. held at Washington, D.C., 5 May 1970; Sponsored by NAS-NRC
Avail: Issuing Activity

The interactions between air and surface modes in transporting freight are briefly described with respect to statute, custom, and legal decisions. The regulations for pickup and delivery areas within a 25 mile zone, within a 68 mile zone, and beyond are mentioned, along those regarding a surface carrier's acquisition of an air carrier and vice versa. It is felt that there are many capabilities to facilitate intermodal domestic transportation, and that international agreements will eliminate impediments to international coordination. N.E.N.

N71-12120# Civil Aeronautics Board, Washington, D.C.

REMARKS BY THE HONORABLE WHITNEY GILLILLAND, VICE CHAIRMAN, CIVIL AERONAUTICS BOARD

1969 9 p Presented at Am. Airlines Ann. Meeting of Regional Vice Presidents and City Managers, Washington, D.C., 13 Nov. 1969
Avail: Issuing Activity

The possible benefits of local and trunk air carrier mergers are briefly discussed. It is pointed out that the local carriers have had a higher rate of capacity growth over the past 15 years than the domestic trunks and that the total 1968 transport revenues of the local service carriers was nearly $43 million more than that of the domestic trunks in 1968. A comparison is made between an actual trunk-trunk merger and a hypothetical merger between average local and trunk carriers with respect to passenger miles, revenue, profit, and investment. It is concluded that if some trunk-local carrier mergers take place, the air carrier system and its members might be financially stronger and the public might be better served and at lower fares. N.E.N.

N71-12152# Joint Publications Research Service, Washington, D.C.

SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 238

13 Oct. 1970 48 p refs Transl. into ENGLISH from Russian reports
(JPRS-51556) Avail: NTIS

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1. ASTRONOMY p 1–3 refs (See N71-12153 02-30)
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3. OCEANOGRAPHY p 10–21 refs (See N71-12155 02-13)
4. TERRESTRIAL GEOPHYSICS p 22 refs (See N71-12156 02-13)
5. UPPER ATMOSPHERE AND SPACE RESEARCH p 23–37 refs (See N71-12157 02-30)
6. SADKO-3 SEALAB UNDERGOES TRIALS p 38–44 refs (See N71-12158 02-34)

N71-12158# Joint Publications Research Service, Washington, D.C.

SADKO-3 SEALAB UNDERGOES TRIALS

In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 238, 13 Oct. 1970 p 38–44 refs (See N71-12152 02-34)
Avail: NTIS

The operational design of the Sadko-3 underwater laboratory is described and initial sea trials are reported. The research crew studied the best methods for conducting hydrophysical, bioacoustical, and medical research, and performed necessary installation work. Operation of the transporting chamber and decompression procedures are also discussed. R.B.

N71-12190# Civil Aeronautics Board, Washington, D.C.

SUBSIDY FOR UNITED STATES CERTIFICATED AIR CARRIERS

Nov. 1969 24 p
Avail: Issuing Authority

The subsidies for American certificated air carriers are identified in dollar amounts, achievements, and standards. The total subsidy for air carrier services for fiscal 1970 is $40,917,000. Summaries by service carrier groups are presented and include: Alaskan, Hawaiian, helicopter, local, and domestic trunklines. The procedures for the determination of the subsidy are given. Tabulated summaries for all certificated carriers for fiscal years 1954 to 1970 are included. F.O.S

N71-12200# Congress. House. Committee on Science and Astronautics.

NATIONAL SCIENCE POLICY: H. Con. Res. 666

Washington GPO 1970 969 p refs Hearings before Comm. on Sci. and Astronaut., 91st Congr., 2d Sess., No. 23, 7–8, 21–23, and 28–29 Jul.; 4–5 and 11–13 Aug.; 15–17 Sep. 1970
Avail: Subcomm. on Sci., Res., and Develop.

Congressional hearings were conducted to discuss the possibility of promulgating a national science policy in the U.S. The purpose of such a policy is to coordinate public and private scientific and related activities to assure the most effective utilization of technological and other resources for scientific purposes. Particular attention is given to general considerations, specific items, and approaches which should be embodied in such a policy. E.H.W.

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Adventures in Research: A History of Ames Research Center, 1940–1965 (NASA SP-4302)

By EDWIN P. HARTMAN

This history of the Ames Research Center from 1940 to 1965 was written by an aeronautical engineer whose principal duty throughout much of the period covered was to observe and report to management on the whole spectrum of aeronautical and space activities in the western United States. Dedicated to Smith J. DeFrance, Director of the Ames Research Center for its first quarter of a century, Hartman's account is a quite personal, generously illustrated addition to the NASA Historical Series.

It describes in considerable detail the laboratory's response to national challenges in two critical periods. Established by NACA shortly before World War II, Ames soon became a leading center for wind tunnel and other studies essential to advances in aeronautical engineering to meet military requirements. In the early 1960's its interests were broadened and its resources enhanced to meet NASA's requirements for the exploration of space. The author stresses the difficulties encountered in both periods, describes the transition, and reviews the many significant technical achievements of the Ames staff. The nature of the problems, the character of the management, and personalities involved are stressed in addition to technical details. *Clothbound.* 576 pp. Available from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for $4.75.

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